Lucas Aerospace

OPERATION AND SERVICE MANUAL

CONTROLLER
MODEL 8200

Lucas Weinschel

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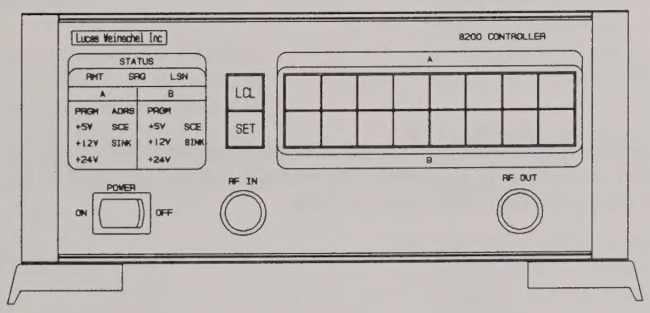
OPERATION AND SERVICE MANUAL

CONTROLLER , MODEL 8200



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GAITHERSBURG, MARYLAND

1989

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SAFETY SUMMARY

DEFINITIONS.

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this manual.

WARNING

An operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in injury and/or death of personnel. Do not proceed beyond a WARNING symbol until all the indicated conditions have been fully understood and/or met.

CAUTION

An operating or maintenance procedure, practice, statement, condition, etc., which, if not strictly observed, could result in damage or destruction of the equipment or long-term health hazards to personnel. Do not proceed beyond a CAUTION symbol until all the indicated conditions have been fully understood and/or met.

NOTE

An essential operating or maintenance procedure, condition, or statement that must be highlighted.

GENERAL PRECAUTIONS.

The following are general precautions that are not related to any specific procedure and, therefore, do not appear elsewhere in this publication. These are precautions that personnel must understand and apply during various phases of instrument operation or service.

WARNING

- Potentially lethal voltages are present in this instrument. Serious shock hazards from voltages above 70 volts may exist in any connector, chassis, or circuit board. Observe the following precautions:
- Use the buddy system any time work involving active high voltage components is required. Turn OFF the power before making/breaking any electrical connection. Regard any exposed connector, terminal board, or circuit board as a possible shock hazard. DO NOT replace any component or module with power applied.
- If test conditions to live equipment are required, make the test equipment ground before probing the voltage or signal to be tested.
- Personnel working with or near high voltage should be familiar with modern methods of resuscitation.
- DO NOT wear jewelry (rings, bracelets, metal watches, and/or neck chains) while working on exposed equipment. Be very cautious about using hand tools near exposed backplanes, bus bars, and/or power supply terminals. Use properly insulated tools. When making test connections to the power supply terminals and bus bars, use only insulated probe tips.
- Verify that the instrument is set to match the available line voltage and the correct fuse is installed.
- DO NOT install substitute parts or perform any unauthorized modification to this instrument. Contact Lucas Weinschel Inc. to acquire any information on replacement parts or returning the instrument for repair. Unauthorized modification can cause injury to personnel and/or destruction of the instrument.
- Operating personnel must not remove instrument covers. Component replacement or adjustments MUST BE performed by qualified service personnel.
- DO NOT operate the instrument near or in the presence of flammable gases or fumes.

DETAILED PRECAUTIONS.

The following WARNINGS, CAUTIONS and NOTES appear throughout the text of this manual and are repeated here for emphasis.

WARNING

- Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the Model 8200 power cord is DISCONNECTED before attempting to change fuses.
- DO NOT connect or apply power to this instrument until the Power Input Assembly has been adjusted to the correct operational line voltage.
- Ensure the facility power is removed before removing or installing any component.
- Soldering and/or unsoldering can cause burns to personnel. Provide adequate ventilation. Avoid breathing the fumes of solder and flux. Personnel should wear approved safety equipment.
- DO NOT use excessive heat when soldering. The use of a low wattage pencil-type soldering equipment is recommended.

CAUTION

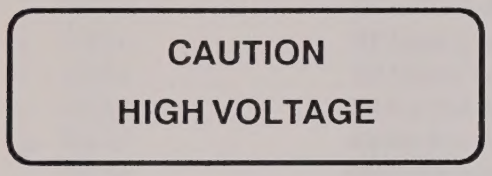
- All procedures and/or steps identified as ⚤ must be followed exactly as written and according to ESDS device handling procedures in IM-210 or other accepted ESDS procedures. Failure to comply WILL RESULT in ESDS damage.
- DO NOT use a nylon bristle brush in the solvent as the bristles may dissolve and cause damage to the circuit card or component.
- DO NOT use ultrasonic cleaning on parts or assemblies containing electrical or electronic components.
- DO NOT bend pins of electrical connectors when using fiber-bristle brush.
- Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/faceshields should be worn. DO NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum of 15 psi to avoid personal injury.
- Under no circumstances should a wire brush, steel wool, or abrasive compound be used for cleaning any surface. Using these items will cause extensive damage to the instruments surface.
- When removing a assembly from the instrument, DO NOT over extend wires/cables beyond their physical limits.
- The Driver Selection switch must be set before power is applied. Changing the position of this switch after power is applied will not affect the operation of the Model 8200.
- When applying an RF signal to the RF INPUT connector, DO NOT exceed the maximum allowable power level specifications of the devices installed in the Model 8200.
- DO NOT change the setting of the Voltage Selector switch with POWER applied.
- Before applying POWER ensure that the voltage selector switch is set to the correct voltage setting for each device to be controlled by the Model 8200.

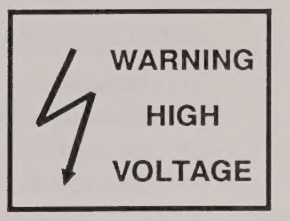
NOTE

- The use of the Planar Crown™ connectors provide the user with easy exchange of connector types, which eliminates the need for adapters and other devices that would create additional insertion loss. This type of connector also provides quick removal and replacement of defective connectors. For more information about the Planar Crown™ connectors contact the Sales Department at Lucas Weinschel Inc.
- DO NOT return any instrument or component to Lucas Weinschel Inc without receiving prior factory authorization.
- Before installing any component or assembly into the instrument, inspect it in accordance with Table 5-1.
- To facilitate installation, bag and mark all mounting hardware and tag all wires/cables during removal with sufficient information to allow reconnection. Then remove tag after installation. This is recommended to ensure proper installation of the component or assembly.
- The Model 3221-2 has a step of 60 dB, that is attained by connecting two 32 dB cells together.

SAFETY SYMBOLS.

The following symbols are used to identify safety hazards found throughout this publication and/or located on the instrument.





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SECTION I
INTRODUCTION AND GENERAL DESCRIPTION

1-1 INTRODUCTION.

1-1.1 PURPOSE. This manual provides Operation and Service instructions necessary to install, service, test, troubleshoot, and operate the Lucas Weinschel Inc (LWI) Model 8200. The manual also provides component location, reference designators, part numbers, and nomenclature to identify all the assemblies and sub-assemblies of the Model 8200, Controller (Refer to Figure 1-1).

1-1.2 SCOPE. This manual shall be used in the operation and maintenance of the Model 8200, using the information provided within this manual. It provides a description of each assembly; testing of the unit; maintenance procedures to maintain the unit; and troubleshooting to a printed circuit board or module assembly.

1-1.3 ARRANGEMENT. The information contained in this manual is tabulated in the Table of Contents, List of Illustrations, and List of Tables. The manual is divided into nine sections, listed as follows:

SECTION I	Introduction and General Description
SECTION II	Installation and Shipment
SECTION III	Operating Instructions
SECTION IV	Device Installation and Setup
SECTION V	Theory of Operation
SECTION VI	Maintenance
SECTION VII	Verification Testing and Troubleshooting
SECTION VIII	Replaceable Parts List
SECTION IX	Diagrams and Circuit Description

1-1.4 RELATED MANUALS. The following manuals contain information that may be used in conjunction with this manual to operate, service, or calibrate the Model 8200.

Manual	Title
H4-1 and H4-2	Federal Supply Code for Manufacturers Cataloging Handbook
IM-211	Quality Assurance Manual, Lucas Weinschel Inc.
IM-219	Attenuator Mounting Instructions

1-1.5 ABBREVIATIONS AND ACRONYMS. The following list contains all abbreviations used throughout this manual. Abbreviations and acronyms that are not listed conform with MIL-STD-12D.

ASSY . . . . . Assembly
CMDS . . . . . Commands
CNTL . . . . . Control
DUT . . . . . Device Under Test
ESDS . . . . . Electrostatic Discharge Sensitive
RPL . . . . . Replaceable Parts List
TYP . . . . . Typical

1-1.6 SAFETY CONSIDERATIONS. Model 8200 is a Safety Class 1 instrument. That is, one provided with a protective earth terminal. The Controller and all related documentation must be reviewed for familiarization with safety markings and procedures before any operation or service. Refer to the SAFETY SUMMARY located at the beginning of this manual for a summary of safety information and procedures. Following these simple safety precautions will ensure safe operation and service of the Model 8200.

1-1.7 CONTACTING LUCAS WEINSCHEL INC. In the event of an instrument malfunction, contact Lucas Weinschel Inc. An apparent malfunction of a instrument or component may be corrected over the phone by contacting the Customer Service Department at Lucas Weinschel Inc. **DO NOT** send the instrument or component back to the factory without prior authorization. When it is necessary to return an item, state the symptoms or problems, catalog and type number of the instrument or component, and date of original purchase. Also write the company name, your name, and phone number on an index card. Then attach the card to the instrument or component to be returned. Paragraph 2-3.1 provides information regarding packing and reshipment. Or contact Lucas Weinschel Inc using the following:

Via mail: **Lucas Weinschel Inc.**
P.O. BOX 6001
One Weinschel Lane
Gaithersburg, MD 20884-0961
U.S.A.

Via Telex: **ITT 440702 (WEIN IU)**

Via Telefax: **301-948-3625**

Via Phone: **Call TOLL FREE 800-638-2048**
toll call # 301-948-3434

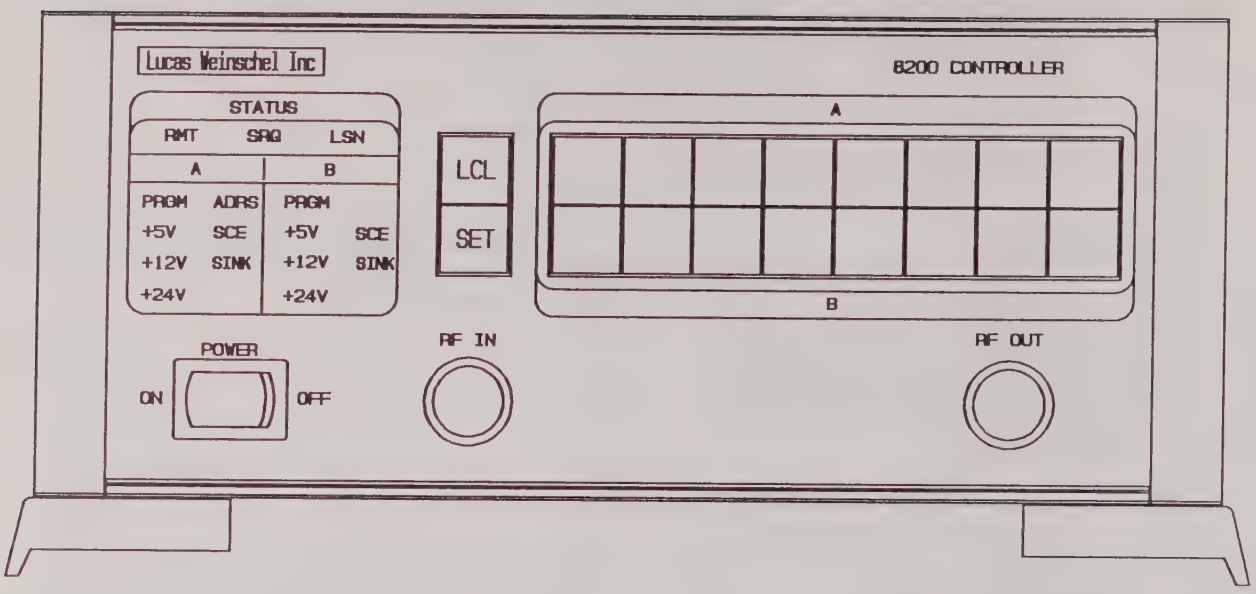


Figure 1-1. Controller, Model 8200

1-1.8 ELECTROSTATIC DISCHARGE SENSITIVE. The equipment documented in this manual contains certain Electrostatic Discharge Sensitive (ESDS) components or parts. Therefore, certain procedures/steps are identified by the use of the symbol ⏚ . This symbol is used in two ways:

CAUTION

All procedures and/or steps identified as ⏚ must be followed exactly as written and according to ESDS device handling procedures in IM-211 or other accepted ESDS procedures. Failure to comply **WILL RESULT** in ESDS damage.

a. When the ESDS symbol ⏚ is placed between a paragraph number and title, all of that paragraph, including all subparagraphs, is considered ESDS device handling procedure.

b. When the ESDS symbol ⏚ is placed between a procedure/step number and the text, all of that procedure is considered an ESDS device handling procedure.

1-2 GENERAL DESCRIPTION.

1-2.1 DESCRIPTION OF EQUIPMENT. The following paragraphs provide a general description of Model 8200 Controller (shown in Figure 1-1) designed by Lucas Weinschel Inc.

1-2.1.1 Functional Description. This general purpose Attenuator\Switch Controller allows the user to control a variety of programmable attenuators, relays, electromechanical switches, and/or TTL compatible devices via either front panel or IEEE-488 GPIB operation.

1-2.1.2 Physical Description. Refer to Table 1-2 for all the physical dimensions for the Controller. The Model 8200 features a POWER ON/OFF switch; two electrically and logically configurable output ports. The Controller is comprised of the following printed circuit board assemblies:

A1 . . . .CENTRAL PROCESSOR UNIT PCB ASSY

A2 . . . . . .DRIVER PCB ASSY

A3 . . . . . POWER SUPPLY ASSY

A4 . . . . . .SWITCH/LED STATUS PCB ASSY

1-2.2 APPLICATIONS. The Model 8200 is capable of driving/controlling many configurations. Using the Lucas Weinschel Inc Models 144, 150, 160, 170, and 3200 series programmable attenuators will provide the user with a wide range of attenuation and frequency performance. The Model 8200 Controller can also provide the user with the following functions:

- Front-Panel and GPIB control of devices. . . functions as a GPIB to parallel data interface for device control, ATE systems, process-control applications, etc.
- 32 push-pull driver pin outputs arranged as 16 complimentary pairs.

- Each push-pull driver configurable via GPIB commands for mode of operation. . .

  - Active Low Output (SINK Mode)
  - Active High Output (SCE Mode)
  - Steady State or Pulsed-Mode Operation
  - Programmable Pulse Width

- Driver voltage is selectable for operation at +5 V, +12 V, or +24 V set via two internal slide switches in groups of eight driver pairs.
- Two opto-isolated input pins provides for general purpose use. They can be used to provide status and error indications back to user via GPIB Bus.
- Can control internally mounted, external, or a combination of devices . RF connections for internal devices can be either on the front or rear panel. External devices can be connected to rear panel 25 pin D connectors for control. +5, +12, and +24 Vdc outputs are available at the rear panel to supply power to user devices.
- Powerful GPIB command set. A macro-like configuration command allows the user to assign and functionally group from 1 to 16 of the output drivers under a user-defined eight character alphanumeric name, identifying pin numbers, driver type, attenuation values (if appropriate), pulse widths, etc. Once assigned, these 'virtual devices' may be accessed via bus commands without regard for any other devices that may be connected.
- Up to 16 'virtual devices' may be assigned at any one time. The configuration data is held in the non-volatile memory.
- Allows programming an attenuator device directly in terms of attenuation values, not in bit images. Automatically determines correct driver pin combinations to provide the requested value. The applications programmer no longer needs to fool with lookup tables, bit-field masks for device position, etc. EASY AND QUICK PROGRAM DEVELOPMENT ! !
- Assignable pins allow for easy physical setup and modifications. For example the user might connect a device with four-control lines to drives 3, 8, 12, and 14 because of existing connections. The Model 8200 takes care of re-mapping the programming information to the correct driver pins, and the user need only provide 4 bits worth of programming information.

1-2.3 SPECIFICATIONS. Table 1-1 lists specifications for the Model 8200, Controller.

1-2.4 RECOMMENDED MATERIALS. Table 1-2 provides a list of recommended consumables to be used when cleaning or servicing Model 8200.

1-2.5 REPLACEABLE PARTS LIST. The Replaceable Parts List (RPL) is located in Section VIII of this manual. The RPL is intended for use in identification, requisition, and issue of parts for Model 8200. All assemblies, subassemblies, cables, and component parts are included in the RPL.

1-2.6 AVAILABLE ACCESSORIES. The following list contains all of the available accessories for Model 8200.

Part/Model NO.	Description
Figure 1-2	Planar Crown Connector System
193-1012	Mounting Kit, 150 Series Attenuator (1)
193-1013	Mounting Kit, 150 Series Attenuator (2)
193-1014	Mounting Kit, 3200 Series Attenuator (1)
193-1015	Mounting Kit, 3200 Series Attenuator (2)
193-1016	Mounting Kit, 3220 Series Attenuator (1)
193-1017	Mounting Kit, 3220 Series Attenuator (2)
193-1018	Rack Mounting Kit, Single 8200 (with 1/2 rack panel)
193-1019	Rack Mounting Kit, Double 8200

1-2.7 OPTIONS. Options are factory modifications of a standard instrument that are either, requested by the costumer or to improve the instruments capability. The Model 8200 can be easily configured to many different customer needs. The Lucas Weinschel Inc 150, 160, 170, and 3200 series programmable attenuators can be readily installed into the Model 8200 using the different mounting kits listed in paragraph 1-2.6. Factory installation of these attenuators is also avaible. For more information or any questions about the Model 8200 Controller and/or other LWI products, contact the Sales Department at Lucas Weinschel Inc.

Table 1-1. Model 8200 Specifications

Specification	Description
Input Power Requirements:	
ac	90 to 130 Vac: 40 to 63 Hz 180 to 250 Vac: 40 to 63 Hz
Environmental:	
Operating Temperature	0° to +50° C (+32° to 104° F)
Storage Temperature	-40° TO +75° C (-40° to +167° F)
Humidity	less than 95%
Electrical Driver Interface:	
Output Driver Configurations	Totem-Pole Driver W/A Darlington Transistor Sink and a Psuedo-Darlington Source. Outputs have clamp diodes for inductive transient supression.
Selectable Driver Voltages, V_{SS}	+5 V, +12 V, or +24 V dc (± 20 %)
dc Power Output	+5 V, +12 V, or +24 V dc @ 1A continuous/2.5 A peak **NOTE:** total combined dc power dissipation of all internal and external devices must not exceed 30 W in continuous operation.
INPUT Status Pins	Active state requires current sink to ground. The input pin will provide approximatey 10 mA of current at a Max voltage of 1.0 V.
Driver Output Current	Peak Output Current, I_{pk}: ±2 A (Nonrepetitive, Pulse Width ≤ 10 msec) Continous Output Current, I_O: ±1 A Continous Total Dissipation at (or below) 25 °C ambient temperature for drivers grouped as follows: Group 1: Drivers 1-4 2 W Group 2: Drivers 5-8 2 W Group 3: Drivers 9-12 2 W Group 4: Drivers 13-16 2 W
Driver Output Voltages:	High Level Voltage, V_{OH} (I_O = -0.5 A): V_{SS} -1.5 V (Min) (I_O = -1mA): V_{SS} -1.1 V (Typ) Low Level Voltage, V_{OL} (I_O = 0.5 A): 1.4 V (Max) (I_O = 1mA): 0.7 V (Typ)
Physical (Figure 1-3):	
Weight	Approximately 7 lbs/3.2 kilograms
Height	3.5 inches/8.89 cm (with feet installed 4.03 inches/10.24 cm)
Width	8.375 inches/21.27 cm
Depth	13 inches/33.02 cm

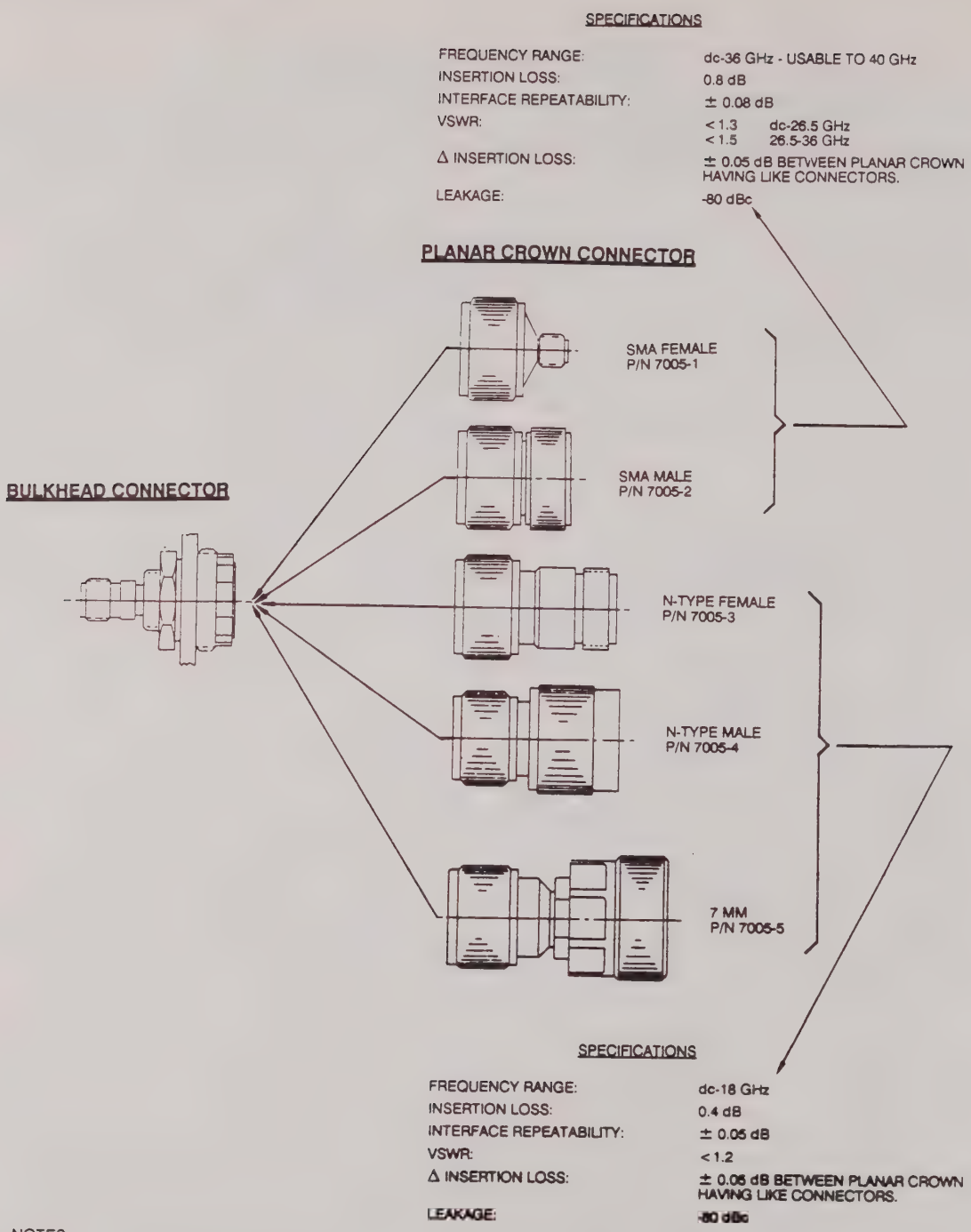
Table 1-1. Model 8200 Specifications

Specification	Description
Connectors:	
Rear Panel Control	25 Pin D Connector, DB25F (2)
RF IN (front)	SMA, Female LWI Model 1568 (other types availiable)*
RF OUT (front)	SMA, Female LWI Model 1568 (other types availiable)*
RF IN (rear)	SMA, Female LWI Model 1568 (other types availiable)*
RF OUT (rear)	SMA, Female LWI Model 1568 (other types availiable)*
Design and Construction:	Designed to meet requirements of MIL-STD-28800C Type III, Class 5, Style E

* Mates NON-Destructively with SMA connectors per MIL-C-39012

Table 1-2. Recommened Consumable Materials

Item Number	Nomenclature	Material	Specification Number	MGR Part Number
1	Acid Brush (Fiber-Bristle)		H-B-643 Type II CLASS 1	
2	Aluminum Wool		MIL-A-4864A	
3	Brush, Soft-Bristle		H-B-420 Type II	
4	Cleaner/Solvent	Isoporpyl Alcohol	TT-1-735A (3)	
5	Cloth, Lint Free		MIL-C-85043 Type IIA	
6	Permanent Polymer Coating (Solder Mask)		IPC-SM-840 Class III	


SPECIFICATIONS
FREQUENCY RANGE: dc-36 GHz - USABLE TO 40 GHz
INSERTION LOSS: 0.8 dB
INTERFACE REPEATABILITY: ± 0.08 dB
VSWR: < 1.3 dc-26.5 GHz
< 1.5 26.5-36 GHz
Δ INSERTION LOSS: ± 0.05 dB BETWEEN PLANAR CROWN HAVING LIKE CONNECTORS.
LEAKAGE: -80 dBc
PLANAR CROWN CONNECTOR
SMA FEMALE P/N 7005-1
SMA MALE P/N 7005-2
BULKHEAD CONNECTOR
N-TYPE FEMALE P/N 7005-3
N-TYPE MALE P/N 7005-4
7 MM P/N 7005-5
SPECIFICATIONS
FREQUENCY RANGE: dc-18 GHz
INSERTION LOSS: 0.4 dB
INTERFACE REPEATABILITY: ± 0.05 dB
VSWR: < 1.2
Δ INSERTION LOSS: ± 0.05 dB BETWEEN PLANAR CROWN HAVING LIKE CONNECTORS.
LEAKAGE: -80 dBc

NOTES:

1. TMC and 3.5 MM type Planar Crown connectors may be available at a later date.
2. For more information on Planar Crown connectors contact Lucas Weinschel Inc.
3. Electronic specifications are based on a mated pair.

Figure 1-2. Planar Crown Connector System

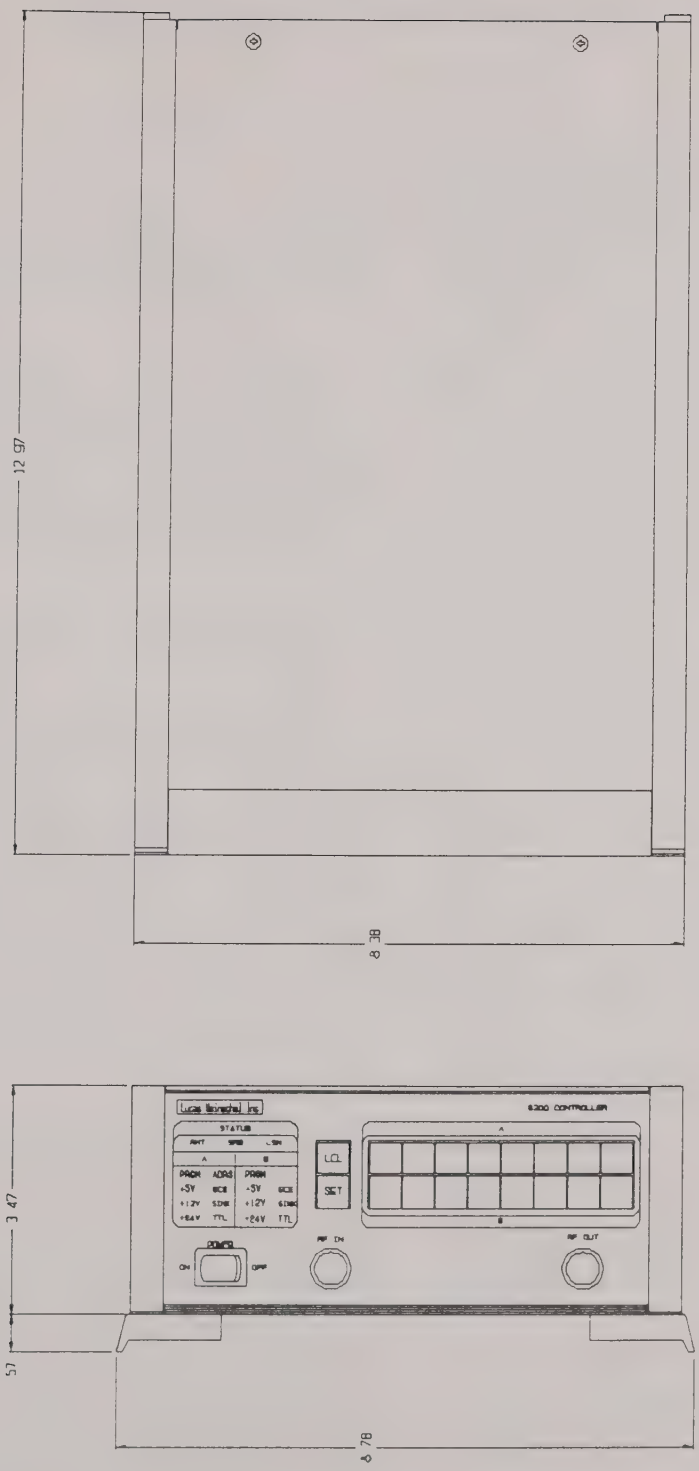


Figure 1-3. Model 8200 Dimensions, Top and Front

Notes:

SECTION II
INSTALLATION AND SHIPMENT

2-1 GENERAL.

This section contains all necessary instructions and information to install and interface the Model 8200 Controller. Included in this section are initial inspection; power requirements; preparation for use; and shipping instructions.

2-1.1 INITIAL INSPECTION. The instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in perfect electrical order upon receipt. After unpacking the instrument do not discard the shipping and packing material until the instrument has been visually inspected and it is determined that reshipment is not necessary. Perform initial inspection in accordance with the following paragraphs.

2-1.1.1 Inspection. Perform the following procedures before removing any item from the shipping container.

a. Visually inspect the shipping container for any discoloration; stains; charring; or any other signs of exposure to heat, moisture, or liquid chemicals.

b. Check for any physical damage to the shipping container such as dents, large snags or rips, crushed sections or areas, and/or similar signs of excessive shock caused by careless handling.

c. Carefully remove the instrument and all other items from the shipping container.

d. Inventory all items against the packing list or the Replaceable Parts List for Model 8200 located in Section VIII of this manual.

e. Inspect the instrument for any dents, cracks, deep scratches, damaged or loose switches and/or knobs, and any other signs of careless handling.

2-1.1.2 Damage. If it has been determined shipping damage has occurred, immediately contact the delivering carrier to perform an inspection and prepare a concealed damage report. Do not destroy any shipping or packing material until it has been examined by an agent of the carrier. Also notify Lucas Weinschel Inc to report the nature and extent of damage to the instrument. When contacting Lucas Weinschel Inc, please provide model and serial number of instrument received, so that the necessary actions can be taken. **DO NOT** return the instrument until a claim for the damages has been established. If there is mechanical damage (not from shipping), the contents are incomplete, and/or the instrument does not function properly, refer to Section I and notify Lucas Weinschel Inc.

2-1.2 POWER REQUIREMENTS. Lucas Weinschel Inc supplies a detachable power cable (P/N 068-21) to connect a 90 to 130 VAC or 180 to 250 VAC power source with a frequency between 48 to 63 Hz to the Controller. Refer to paragraph 2-2.2 (Initial Setup) before applying any power to the instrument.

2-1.3 ENVIRONMENTAL REQUIREMENTS. The Controller operates best within its specifications at an ambient temperature of 0° to +50° C. Operating beyond these limits can effect the accuracy of the instrument and damage internal circuitry.

2-2 PREPARATION FOR USE.

The following paragraphs provide mounting instructions, Initial Setup, line voltage and fuse selection, and input/output options for the Model 8200 Controller.

2-2.1 MOUNTING INSTRUCTIONS. The Controller is shipped with four plastic feet mounted to the bottom cover, this allows the user to place the instrument on any bench or to stack the 8200 with other Lucas Weinschel Inc instruments. When the Model 8200 is placed on a bench or table, these feet provide a level support. The Model 8200 can also be rack mounted as a single unit using Rack Mounting Kit (P/N 183-1018) or two Model 8200's can be mounted together using Rack Mounting Kit (P/N 183-1019). Using these kits will allow the Model 8200 to be mounted in any rack or cabinet that is designed according to EIA RS-310 or MIL-STD-189.

2-2.2 INITIAL SETUP. The initial setup procedure for operating and servicing the Controller is as follows:

a. Perform inspection paragraph 2-1.1.1 prior to connecting the 8200 to any power source.

b. Ensure the Power Input Module Assembly is adjusted to the proper voltage setting (Refer to paragraph 2-2.3).

c. Check the external power source outputs to the 8200 are in accordance with Table 1-1, Model 8200 Specifications.

d. Connect the 8200 to the external power source.

e. Perform all the Performance Test and Verification procedures (located in Section VII) to ensure proper operation of the 8200.

2-2.3 INPUT/OUTPUT OPTIONS. The following paragraphs provides a description of the connections that can be made to the Controller. Figures 2-1 and 2-2 show the location of these connectors.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the 8200 power cord is DISCONNECTED before attempting to change fuses.

2-2.3.1 Power Entry Module Assembly. The Power Entry Module Assembly contains a three-prong ac power input connector and a voltage selector/ fuse assembly (Figure 2-1).

The **Voltage SelectorModule and Fuse Drawer** reconfigures the Controller to different operating voltages. This assembly contains a line voltage fuse and voltage selector module. Refer to paragraph 2-2.3 for replacement of the fuse and/or proper alignment of the voltage selector module to change the operational power requirements to either 110 or 220 Vac.

The **AC Power Connector**, located on the bottom side of XF1 (Figure 2-1), is a plug-type, prong insert connector with three conductors for connection of the power cord (P/N 068-21) to the Power Supply Assembly located within the Controller. This connector also grounds the chassis of the Controller when the the ac power cord is connected to a grounded wall outlet. If necessary, use a three prong to two prong adapter and connect the adapter's ground lead to the outlet plate retaining screw.

CAUTION

When applying an RF signal to the RF INPUT connector, DO NOT exceed the maximum allowable power level specifications of the devices installed in the Model 8200.

NOTE

The use of the Planar Crown™ connectors provide the user with easy exchange of connector types, which eliminates the need for adapters and other devices that would create additional insertion loss. This type of connector also provides quick removal and replacement of defective connectors. For more information about the Planar Crown™ connectors contact the Sales Department at Lucas Weinschel Inc.

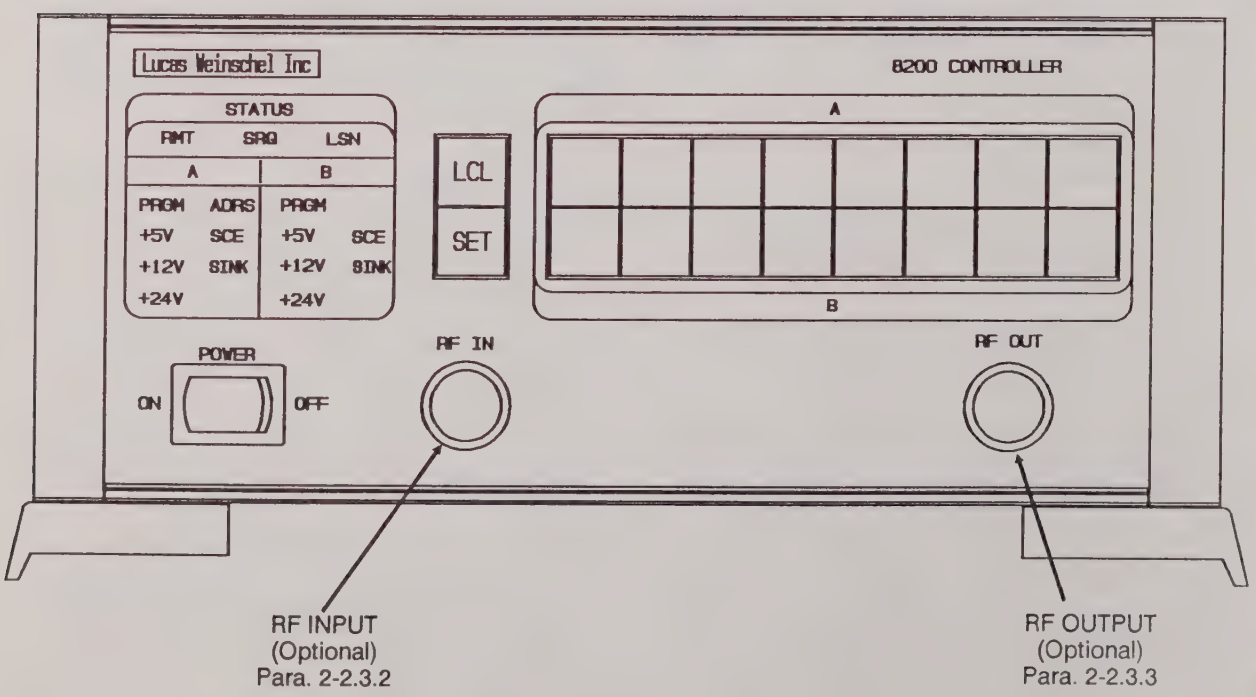


Figure 2-1. Model 8200 Connector Location (FRONT)

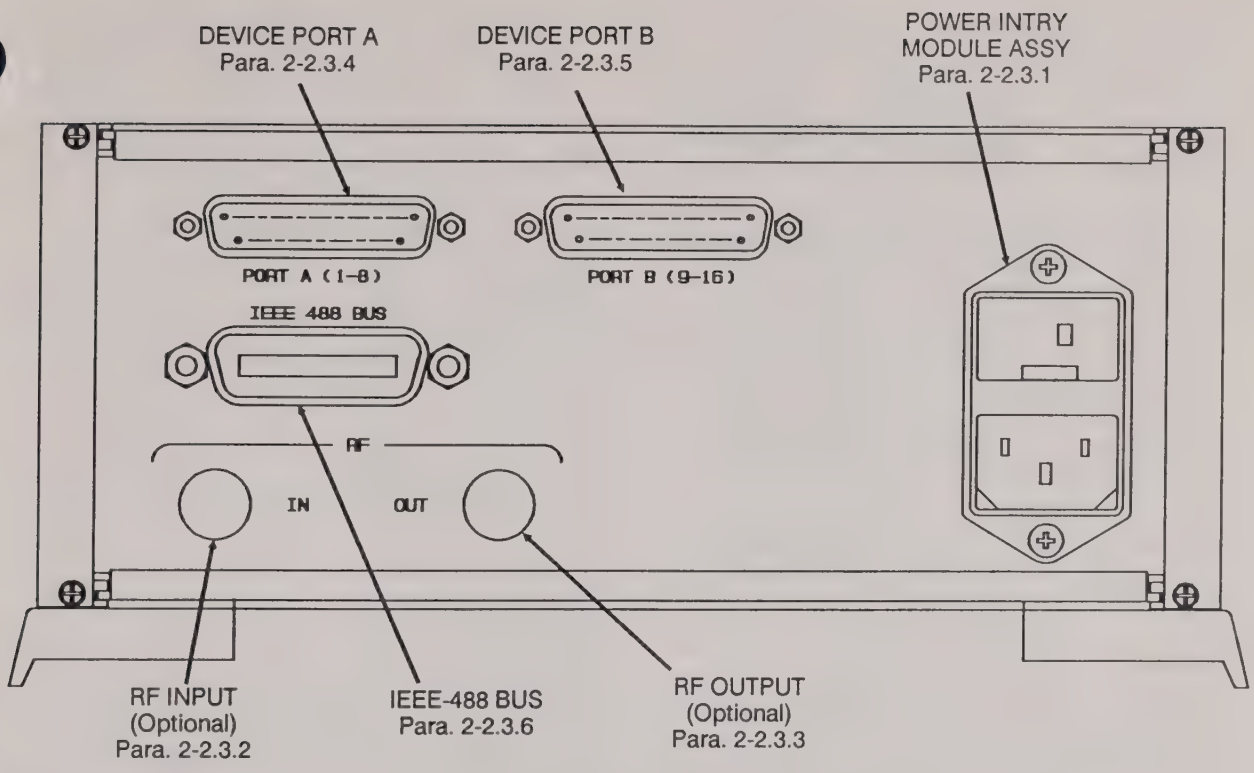


Figure 2-2. Model 8200 Connector Location (REAR)

2-2.3.2 RF Input Connector (Front/Rear Panel). This connector (Figures 2-1 and 2-2), whether mounted on the front or rear panel of the Model 8200, provides an input port where various types of RF signal can be applied to the devices internally mounted in the Model 8200.

2-2.3.3 RF Output Connector (Front / Rear Panel). This connector (Figure 2-1 and 2-2), wheather mounted on the front or rear panel of the Model 8200, outputs the various signals produced or altered by the devices located in the Model 8200.

2-2.3.4 Device Port A. This 25 pin rectangular subminiature D connector (Figure 2-2) that protrudes through the rear panel, but is mounted on Driver PCB Assembly is used to carry the necessary voltages and control signals to devices that will be controlled externally by the Model 8200. The Driver PCB Assembly also contains an internal square connector (will mate with ITT Cannon P/N DBSF-25S) to supply Port A voltages and control signals to internally mounted devices. Table 2-1 lists voltage and signal designator for each contact pin located in these connectors.

2-2.3.5 Device Port B. This 25 pin rectangular subminiature D connector (Figure 2-2) that protrudes through the rear panel but is mounted on the Driver PCB Assembly is used to carry the necessary voltages and control signals to devices that will be controlled externally by the Model 8200. The Driver PCB Assembly also contains an internal 25 pin square connector (will mate with ITT Cannon P/N DBSF-25S) to supply Port B voltages and control signals to internally mounted devices. Table 2-2 lists voltage and signal designator for each contact pin located in these connectors.

2-2.3.6 IEEE-488 INTERFACE BUS. Joining the Model 8200 to a system controller requires the connection of IEEE-488 control bus cable to the IEEE-488 INTERFACE BUS connector located on the rear panel Figure (2-2). The IEEE-488 INTERFACE BUS connector carries program command and data signals passing between the Model 8200 and a system controller. Figure 2-3 shows the connector's contact pin numbering scheme and Table 2-3 lists the signal designator for signal present at each contact pin.

2-2.4 LINE VOLTAGE AND FUSE SELECTION. The following steps provide procedures to reconfigure the line voltage and replace the Fuse Assembly. Table 2-4 lists fuse requirements for the available operational voltages. Model 8200 accepts American type fuses (0.250" DIA x 1.250")

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Ensure that the 8200 power cord is DISCONNECTED before attempting to change fuses.

Table 2-1. Device Port A Signal Designators

Signal Name	Rear Panel Connector (A2J1) Pin No.	Internal Connector (A2J5) Pin No.
+5 V	1	1
+5 V	14	2
+12 V	2	3
+12 V	15	4
+24 V	3	5
+24 V	16	6
GND	4	7
GND	17	8
/DRIVER1	21	16
/DRIVER2	8	15
/DRIVER3	20	14
/DRIVER4	7	13
/DRIVER5	19	12
/DRIVER6	6	11
/DRIVER7	18	10
/DRIVER8	5	9
DRIVER1	25	24
DRIVER2	12	23
DRIVER3	24	22
DRIVER4	11	21
DRIVER5	23	20
DRIVER6	10	19
DRIVER7	22	18
DRIVER8	9	17
/IN_A	13	25

Table 2-2. Device Port B Signal Designators

Signal Name	Rear Panel Connector (A2J2) Pin No.	Internal Connector (A2J6) Pin No.
+5 V	1	1
+5 V	14	2
+12 V	2	3
+12 V	15	4
+24 V	3	5
+24 V	16	6
GND	4	7
GND	17	8
/DRIVER9	21	16
/DRIVER10	8	15
/DRIVER11	20	14
/DRIVER12	7	13
/DRIVER13	19	12
/DRIVER14	6	11
/DRIVER15	18	10
/DRIVER16	5	9
DRIVER9	25	24
DRIVER10	12	23
DRIVER11	24	22
DRIVER12	11	21
DRIVER13	23	20
DRIVER14	10	19
DRIVER15	22	18
DRIVER16	9	17
/IN_B	13	25

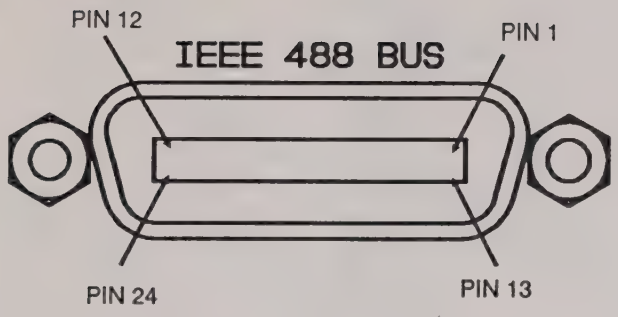


Figure 2-3. IEEE-488 Interface Bus Pin Locations

CAUTION

DO NOT connect or apply power to this instrument until the Power Entry Module Assembly has been adjusted to the operational line voltage.

a. Disconnect the power cord from the Power Entry Module Assembly (Figure 2-4).

b. Use small screwdriver to pry open the Fuse Drawer.

c. Slide out Fuse Drawer located at the lower right corner of the Power Entry Module Assembly.

d. Remove the fuse from the Voltage Selector Module and replace with the correct fuse according to the fuse requirement (Table 2-4) for the operational line voltage used.

Table 2-3. IEEE-488 INTERFACE BUS Signal Designators

Pin No.	Signal Line	Pin No.	Signal Line
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI (24)**	17	REN (24)**
6	DAV	18	GND (6)*
7	NRFD	19	GND (7)*
8	NDAC	20	GND (8)*
9	IFC	21	GND (9)*
10	SRQ	22	GND (10)*
11	ATN	23	GND (11)*
12	SHIELD	24	GND, LOGIC

*** GND (N) refers to the signal ground return of the referenced pin.**
**** Return on pin 24.**

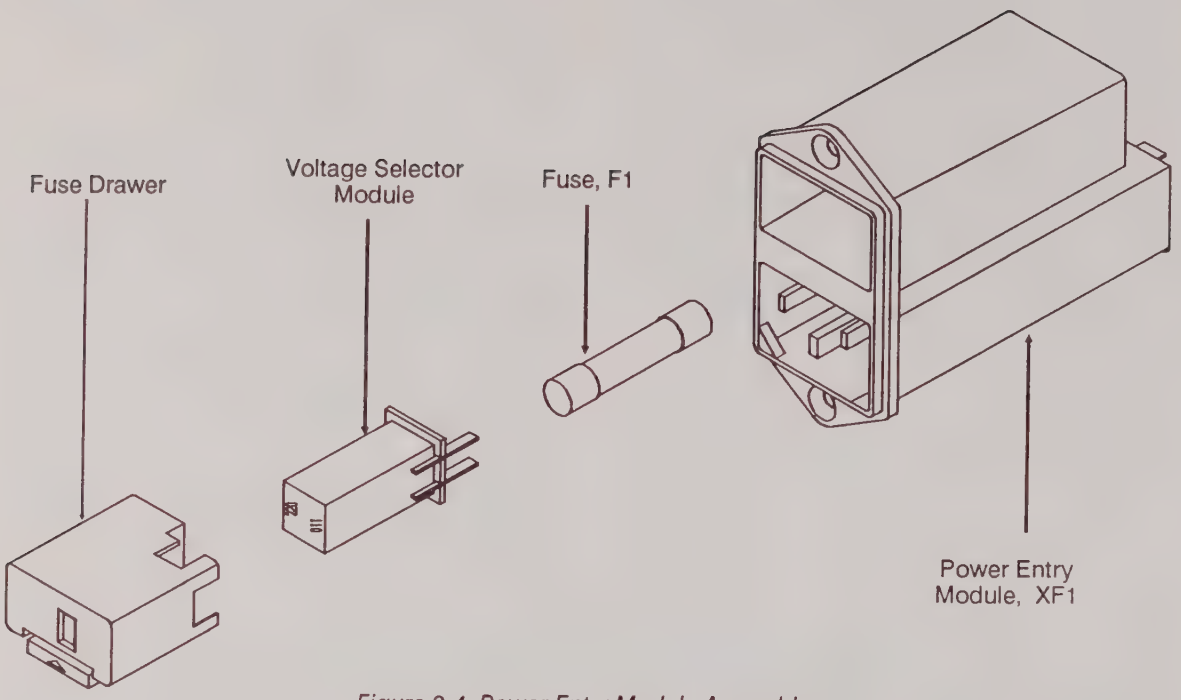


Figure 2-4. Power Entry Module Assembly

NOTE

For Fuse replacement skip step "e". Table 2-4 provides the fuse part numbers for each of the operational line voltage selections.

e. Install the Voltage Selector Module so that the operational line voltage desired is visible through the cutout in the Fuse Drawer.

f. Carefully slide the Fuse Drawer/Voltage Selector Module/Fuse into the Power Entry Module.

g. Snap the Fuse Drawer shut and reconnect ac power cord.

2-2.5 CHANGING PORT A OR B SWITCH NOMENCLATURE. The use of this type of switch provides the user with the ability to change the nomenclature of the switch to match the value of an attenuator installed into the Model 8200 or designate a device that is being controlled by the Model 8200. LWI provides different nomenclature that can easily be installed into these switches. The following procedures will aid in changing the nomenclature of these switches.

a. Using a small screwdriver carefully remove the lens and switch cap from the switch to be changed (Figure 2-5).

b. Select the desired nomenclature from suplied sheet. Using a sharp object carefully cut inside the line around the nomenclature (trim as necessary).

Table 2-4. Model 8200 Line Voltage Fuse Requirements

Operational Line Voltage	Fuse Requirement	LWI Part No.
90 to 130 Volts ± 10 % at 48 to 62 Hz	1/2 AMP Slo-Blo	052-1-1/2SB
180 to 250 Volts ± 10 % 48 at 62 Hz	1/4 AMP Slo-Blo	052-1-1/4SB

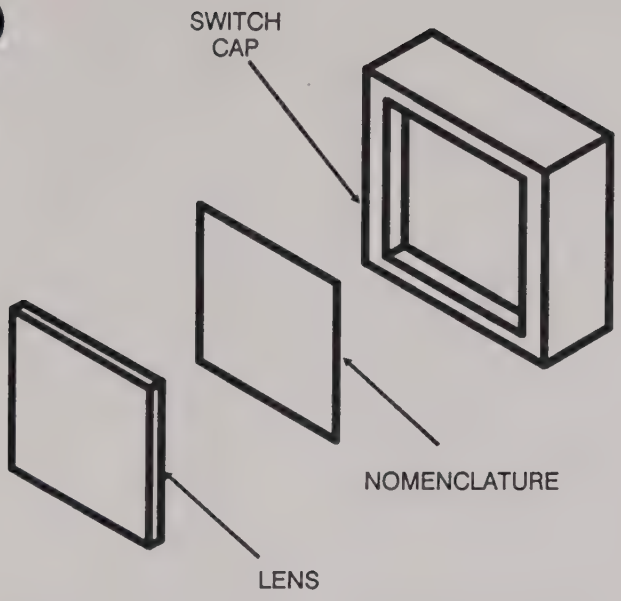


Figure 2-5. Changing Port A & B Switch Nomenclature

c. Remove unwanted nomenclature (if installed) and replace with desired nomenclature from the supplied sheet.

d. Carefully snap lens onto the switch and replace. Repeat steps "a" thru "c" to change remaining switches.

2-3 PREPARATION FOR RESHIPMENT OR STORAGE.

2-3.1 RESHIPMENT. Perform the following procedure when reshipping an instrument or component to Lucas Weinschel Inc.

NOTE

- **DO NOT** return any instrument or component to Lucas Weinschel Inc without receiving prior factory authorization.
- Use the best available packing materials to protect the instrument during reshipment. When possible, use original shipping container and packing materials.

a. Cover the front panel and/or connectors with plastic connector covers.

b. Wrap instrument with sturdy paper or plastic.

c. Place all accessories, cables and lose hardware into a plastic bag.

d. Place the wrapped instrument into a strong container with a layer of shock absorbing material (3/4 inch thickness) wrapped around all sides of the instrument to provide a firm cushion and to prevent movement inside the container.

e. Place bag of accessories and hardware into container.

f. If shipping the instrument for service, attach a tag to indicate the following:

- Model and serial number
- Service required
- Description of malfunction
- Return address
- Authorization to conduct repairs
- Instrument repair authorization

g. Thoroughly seal shipping container and mark it FRAGILE.

h. Ship to either an authorized sales representative or:

Lucas Weinschel Inc.
One Weinschel Lane
Gaithersburg MD. 20877
U.S.A.

2-3.2 STORAGE. When Model 8200 is to be stored for extended periods, pack instrument into a container using paragraph 2-3.1, steps a thru d. Place container in a clean, dry, temperature-controlled location. If instrument is to be stored in excess of 90 days, place desiccant with items before sealing container. The safe environmental limits for storage of Model 8200 are as follows:

Temperature:	-40 degrees to +167 degrees F (-40 to 75 degrees C)
Humidity:	less than 95%

Notes:

SECTION III
OPERATION

3-1 GENERAL.

This section contains a description of all controls and indicators located on the instrument and instructions necessary to operate the Model 8200.

3-2 FRONT CONTROLS AND INDICATORS.

The following paragraphs provides a description of all controls and indicators located on the front panel of the Model 8200. Figure 3-1 shows the location of all the switches and indicators on the Model 8200.

3-2.1 STATUS INDICATORS. The STATUS indicators (DS17 thru DS34) located on the Switch\LED Status PCB Assembly, A3, is divided into the following three groups:

GPIB- This group of LEDs indicates the status of the GPIB bus operation as follows:

- RMT(DS22) LED illuminates when the Model 8200 is in the REMOTE mode (after receiving the MLA command).
- SRQ (DS21) LED illuminates when the Model 8200 is asserting the GPIB SRQ line.
- LSN (DS20) LED illuminates when the Model 8200 is receiving data from the GPIB Bus.

Device A- This group of LEDs indicates the status of Device Port A as follows:

- PRGM (DS18) LED flashes when a data switch for Device Port A has been depressed.
- ADRS (DS19) LED indicates the Device Port A switch bank is currently being used to set or display the GPIB address.
- +5 V (DS34) LED indicates that +5 V is the current setting for the Device Port A's operational voltage.
- +12 V (DS33) LED indicates that +12 V is the current setting for the Device Port A's operational voltage.
- +24 V (DS32) LED indicates that +24 V is the current setting for the Device Port A's operational voltage.

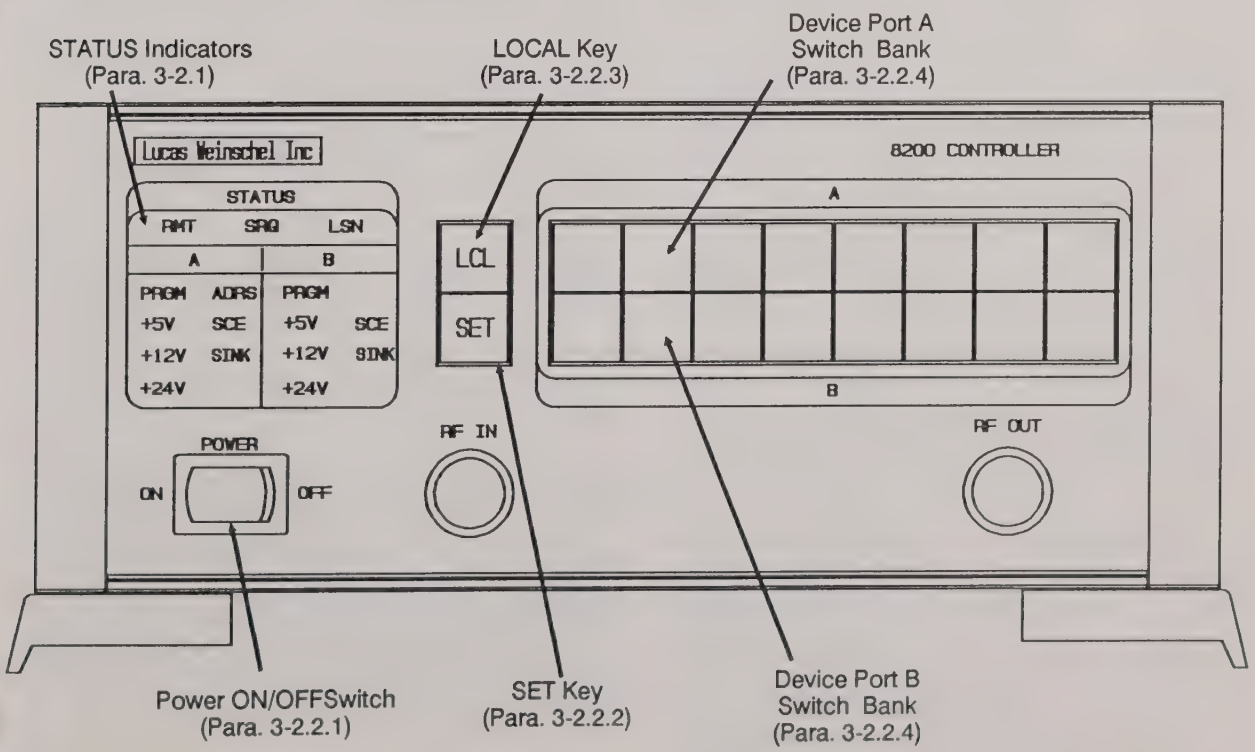


Table 3-1. Model 8200 Controls and Indicators

- SINK (DS28) LED indicates that the output drivers are in the sink current mode.
- SRC (DS28) LED indicates that the output drivers are in the source current mode.

Device B- This group of LEDs indicates the status of Device Port B as follows:

- PRGM (DS17) LED flashes when a data switch for Device Port B has been depressed.
- +5 V (DS31) LED indicates that +5 V is the current setting for the Device Port B's operational voltage.
- +12 V (DS30) LED indicates that +12 V is the current setting for the Device Port B's operational voltage.
- +24 V (DS29) LED indicates that +24 V is the current setting for the Device Port B's operational voltage.
- SINK (DS24) LED indicates that the output drivers are in the sink current mode.
- SRC (DS25) LED indicates that the output drivers are in the source current mode.

3-2.2 CONTROL SWITCHES. The following paragraphs provide a brief description of each switch located on the front panel of the Model 8200 Controller.

3-2.2.1 Power ON/OFF Switch. The POWER ON/OFF switch (S1) protrudes through a rectangular cutout in the lower left front Panel. Placing the POWER ON/OFF switch in the ON position applies power to the instrument and causes the ADRS LED to illuminate, and the GPIB address (displayed in Binary Format) will be displayed in the Device Port A LEDs. The PRGM LED is illuminated and current software rev is displayed in the Device Port B LEDs. This information disappears after approximately 5 secs. Voltage setting for Device Ports A and B are displayed in the appropriate LEDs. The driver modes are displayed in the respective port displays for each of the types of drivers that are configured.

3-2.2.2 SET Key. The SET Key (A3S17) is used to program the selected Device Port or GPIB address information.

3-2.2.3 LOCAL Key. The LOCAL Key (A3S17)serves a dual function. If the device is in the GPIB REMOTE mode (REM LED is ON), depressing the key will return the Model 8200 to LOCAL mode operation and the REM LED will no longer be illuminated. The LOCAL Key also allows the operator to view and/or change the Model 8200 GPIB address. Depress the LOCAL Key once to view the current address, this causes the ADRS LED to illuminate and the current address is displayed on Device Port A switch bank LEDs. This will allow the address to be changed using the Device Port A switches, just as if the device was being programmed (PRGM LED will begin to flash to indicate the editing mode). When the desired address is displayed, pressing the SET Key will program the address into the Model 8200. The PRGM LED(s) will cease to flash and the Model 8200 will return to displaying the Device Port A data. The address information is filed in the internal non-volatile storage. If there was no change initiated after the LOCAL Key was pressed, the Model 8200 automatically returns to displaying the Device Port A data after five seconds and the ADRS LED is no longer illuminated. The address information is displayed in binary; LSB is displayed in A3S1; and MSB is displayed in A3S5 (from right to left).

3-2.2.4 Device Port A & B Switch Bank. Each Device Port contains a Bank of eight illuminating Keys (A3S1 thru A3S8 for Port A and A3S9 thru A3S16 for Port B)that operate in a toggle fashion, ie, push for ON and push for OFF. Note that the ON/OFF states of the driver outputs have different electrical characteristics depending upon the driver mode selected (Refer to paragraph 3-8 for driver pin output operational settings).

3.3 FRONT PANEL OPERATION (LOCAL). To set a particular control signal to a device ON or OFF, depress the appropriate key in the Device Port A or B switch bank. The respective key toggles its current setting and the LED change to match. After adjusting the current setting the Device Port A/Port B PRGM indicator will begin to flash, indicating that changes are being made. Set the desired settings of all switches, and then to actually program the device, depress the SET Key. The PRGM LED (s) will cease to flash indicating that the the displayed information has been programmed. The Status Indicators will return to displaying all driver functions.

3-4 USING THE MODEL 8200 's VIRTUAL PORT CONFIGURATION SOFTWARE.

The Model 8200 offers 32 programmable driver pin outputs that are arranged as 16 complimentary pairs. The configuration of each of the 16 driver pairs is individually programmable as to its electrical mode of operation. Each pair can be programmed to operate using sink/source current and to operate in a continuous drive or pulsed-mode output. The drivers are physically grouped into two banks, or ports, referred to as Port A and Port B. Each port offers eight driver pairs, and can independently be set via internal switches to operate at one of three dc voltages (+5 V, +12 V, or +24 V).

The two ports, even though physically separate, are considered by the software to be a collection of 16 driver pair outputs. These output drivers may be logically grouped together in any physical arrangement and assigned a name, creating a virtual output port that may be accessed and programmed by the selected name, without affecting any other devices that may be connected to the same port. This greatly eases the programming task, as the user no longer need deal with bit masks and Boolean operations to control separate devices.

PORT A

Driver 8 A3S8	Driver 7 A3S7	Driver 6 A3S6	Driver 5 A3S5	Driver 4 A3S4	Driver 3 A3S3	Driver 2 A3S2	Driver 1 A3S1

PORT B

Driver 16 A3S16	Driver 15 A3S15	Driver 14 A3S14	Driver 13 A3S13	Driver 12 A3S12	Driver 11 A3S11	Driver 10 A3S10	Driver 9 A3S9

Figure 3-2. Driver Locations (Ports A and B)

Driver pairs 1 thru 8 are available on Port A, while Drivers 9 thru 16 are contained on Port B. The driver pins are mapped into the front panel keys as shown in Figure 3-2. Each port also contains a single input pin that can be used to signal status or error indications back to the user via the GPIB bus.

The Model 8200 provides the user with the ability to create and store up to 16 individual device configurations. Each configuration may consist of from 1 to 16 drivers. These configurations may be copied, edited, and combined to create the ability not only to control a variety of devices, but to be able to combine devices into a single programmable entity. The user may, for example, combine the definitions for two different step attenuators in order to create a nonstandard configuration.

3-5 MODEL 8200 GPIB BUS OPERATION.

The following paragraphs describe the Model 8200 IEEE-488 functions.

3-5.1 INTERFACE FUNCTIONS. Table 3-1 summarizes the IEEE-488 interface functions that are implemented by the Model 8200.

3-5.2 BUS ADDRESS. The Controller's GPIB Bus address is selectable from 0 to 30 via the Front Panel using the Device Port A switch bank. Refer to paragraph 3-2.2.3 to set or display the bus address.

3-5.3 SYNTAX OF REMOTE INSTRUCTIONS. The Model 8200 recognizes instructions and data sent thru the GPIB interface in the form of program messages composed of ASCII characters. A program message is comprised of a sequence of program message units separated by semicolons and terminated by a line terminator (LINE END). A line terminator takes the form of an ASCII Line-Feed character (0AH), or an EOI signal asserted with the last data byte, or both. The Model 8200 program message units may be divided into two syntax groups commands and queries.

NOTE

In the descriptions that follow, the term whitespace is used to define a sequence of one or more combinations of ASCII Space (20h),Carriage return (0Dh), or Tab (09h) characters.

3-5.4 SYNTAX OF QUERIES. A query message unit is made up of a query header ending in an ASCII question mark character '?' (3FH), followed by optional whitespace, and ended by a program message terminator. To form a multiple query, separate the individual program message units with a semicolon.

Examples :

a. Query Commands:

"LIST?"
"SET?"

b. Multiple Query Commands:

"LIST?; SET? A"

3-5.5 SYNTAX OF COMMANDS. A command message unit is made up of a command header of up to twelve characters in length, optionally followed by an argument and units, and ended by a program message terminator. If multiple commands are made on the same program line, separate the individual command messages with a semicolon.

3-5.5.1 Arguments. The three types of arguments that can be used in a program command are :

- Character Program Data
- Integer Numeric Program Data
- Non-Integer (Real) Numeric Program Data

Table 3-1. Interface Functions

Interface Function	Subset	Description
Source Handshake	SH1	Fully implemented.
Acceptor Handshake	AH1	Fully implemented.
Talker	T5	All basic Talker functions are implemented. No extended addressing.
Listener	L3	All basic Listener functions are implemented. No extended addressing.
Service Request	SR1	Service Request fully implemented.
Remote Location	RL2	No Local Lock Out.
Parallel Poll	PP0	No Parallel Poll capability.
Device Clear	DC1	Fully implemented.
Device Trigger	DT1	Fully implemented.
Controller	C0	Controller functions are not currently implemented.
Electrical Interface	E2	All Tri-state I/O buffers.

Each type of program data has its own rules of syntax. The following paragraphs provide the rules of syntax for each of the arguments listed.

3-5.5.2 Character (CHAR) Program Data. Conveys parameter information in short alpha or alphanumeric strings. The use of alpha characters is case-insensitive. The length of the Character Program Data is determined by the syntax of the command. Valid examples are the strings 'ON' and 'OFF'.

3-5.5.3 Integer Numeric Program Data. Integer Numeric Program Data is integer, binary, or hexadecimal information, all of which may be used interchangeably. Integer data is composed of the numeric digits '0' thru '9', and is limited to a maximum of 15 digits, although the command may place further restrictions on the range of acceptable values. Binary program data is composed of a series of '0' and '1' digits beginning with number symbol '#' and the letter 'B'. Binary data is limited to a maximum of 16 digits. Hexadecimal program data is composed of the digits '0' thru '9' and the letters 'A' thru 'F' (representing 10 thru 15) beginning with the number symbol '#' and letter 'H'. Hexadecimal data length is limited to 4 hex digits. Examples of valid integer program data include 12, #H000C, #B1100, 4096, #H0FFF, #B0100101.

3-5.5.4 Real Numeric Program Data. Decimal numbers which may be positive or negative having no more than 32 characters. The decimal numbers may have an decimal point, and/or an exponent. The format is as follows, where the symbols indicate the use of an optional item.

< sign > digits < . > < digits > < E < sign > < digits >

No whitespace may be used anywhere inside the definition of real program data. Valid examples of this data type are : 2, +2, 2.5, +12.3, 12.345E+9, 30000.0E-3

3-5.6 OUTPUT DATA FORMAT. Output data from the Model 8200 consists of a series of ASCII digits and message strings, terminated with an ASCII Line-Feed character (0AH), in response to a program message that contains one or more query commands. In the case of multiple query commands in the same program message, the data resulting from each of the individual message units will be separated by an ASCII comma (2CH) character. Data in the output buffer is valid when the MAV (message available) bit in the Status Register is set.

3-5.7 STATUS REGISTER BIT DEFINITIONS. The Status Register contains the data that is placed in the output buffer in response to a GPIB Serial Poll. Each of the individual bits of the Status Register may be enabled/disabled from asserting the SRQ line by the use of the SRE status register enable command.

BIT 7 -	OPC	Operation Complete
BIT 6 -	SRQ	Service Request
BIT 5 -		Not Used
BIT 4 -	MAV	Message Available
BIT 3 -		Not Used
BIT 2 -	QYE	Query Error
BIT 1 -	EXE	Execution Error
BIT 0 -	CME	Command Error

OPC - asserted in response to an OPC command. Indicates that the requested operation is complete.

SRQ - asserted when the Model 8200 Status Register contains a valid service request.

MAV- asserted when valid data is placed in the output buffer.

QYE - error flag, indicates that the result of a previous query message was not read by the Model 8200, and that data has been lost.

EXE - error flag, indicates that the Model 8200 was unable to complete the requested operation due to an internal error condition.

CME - error flag, indicates that an invalid command or argument syntax was received.

3-5.8 ERROR CODES AND MESSAGES. The following is a list of the error codes and messages that are sent in response to the ERR? query command, once having received an error indication in one of the error status bits of the status register (ie, QYE, EXE, CME). The format of the error message is a four-digit hex code along with a text string describing the error, and in the case of an input error, followed by an ASCII ':' (3AH) delimiter and the offending input data that caused the error.

'1001h Null Cmd'
'1011h Cmd invalid'
'1021h Arg not allowed'
'1031h Arg missing'
'1041h Extra Arg'
'1051h Arg invalid'
'2001h Arg Range Error'
'2011h Arg Type Error'
'2021h Device name unknown'
'2031h Units invalid'
'2041h Device does not support ATTN mode.
'2051h Internal Error.'
'2061h Device Table full.'

ERROR CODES AND MESSAGES (Con't).

'2071h Cannot delete system defined name.'
'2081h Device name to long.'
'2091h Device name not found.'
'20A1h Command is currently unsupported.'
'20B1h Device name is already in use.'
'20C1h No drivers are assigned to device.'
'3001h Previous Query results not read.'

3-5.9 DEVICE-DEPENDENT COMMANDS. Table 3-2 provides a list of the device-dependant commands and queries for the Model 8200.

3-5.10 NOTATIONAL CONVENTION.

[ ]	Brackets indicate optional arguments or parameters.
{ }	One and only one of the enclosed entries must be selected unless the field is also surrounded by brackets, in which case it is optional.
...	Ellipses indicate that the preceding argument or parameter may be repeated.
[,...]	The preceding item may be repeated, but each repetition must be separated by a comma.

3- 6 VOLTAGE SELECTORS.

Each port contains a Voltage Selector switch (located on the Driver PCB Assembly, Figure 3-3) that sets the operational voltage for each of the eight drivers contained in the port. This switch must be set to match the device being controlled; select one from +5 V, +12 V, or +24 V operation.

CAUTION

- **DO NOT** change the settings of the Voltage Selector switch with **POWER** applied.
- Before appling **POWER** ensure that correct voltage is selected for each device to be controlled by the Model 8200.

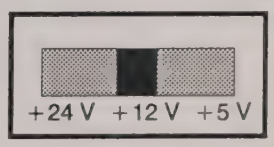


Figure 3-3. Voltage Selector Switch

3-7 SETTING DRIVER TYPES. The driver types are selectable for Device Ports A and B via a configuration DIP switch located on the Driver PCB Assembly, as well as via GPIB configuration commands. In local mode of operation, the DIP switch (Refer to Figure 3-4) sets the Power-ON default driver types for Device Ports A and B. This DIP switch is comprised of eight switches, four for each port (A and B). Select only one of SRC or SINK by placing the switch in the ON position; the other two should be in the OFF position. In addition, set the PULSE switch to the desired setting...ON for pulse operation, OFF for steady-state. To allow GPIB configuration of the power on setting of the driver type, set all four switches for the port to the OFF position. In the remote mode of operation, all driver type information for user-defined devices, as well as Device Ports A and B, may be taken from the configuration programming information provided when a device is created.

CAUTION

Changing the Driver Type Selection after power has been applied will not affect the operation or the outputs of the Model 8200. This switch MUST be set before power is applied.

Switch 1 - Pulse mode (Port A)
Switch 2 - SCE (Port A)
Switch 3 - SINK (Port A)
Switch 4 - Not Used
Switch 5 - Pulse mode (Port B)
Switch 6 - SCE (Port B)
Switch 7 - SINK (Port B)
Switch 8 - Not Used

Figure 3-4. Driver Type Selection Switch

3-8 DRIVER PIN OUTPUT OPERATIONAL SETTINGS.

The following lists describes how the driver pins function electrically for each of the operational modes. +V equals the voltage of the respective port as chosen by the ports Voltage Selector Switch (+5, +12, +24) located on the Driver PCB Assembly. The notation 'passive' indicates that a driver is inactive and is neither in the Sinking or Sourcing Current modes.

CONTINUOUS OPERATION:

SINK Mode	ON (1)	OFF (0)
Driver	0 V	+V
/Driver	+V	0 V
SCE Mode	**ON (1)**	**OFF (0)**
Driver	+V	0 V
/Driver	0 V	+ V

PULSE MODE:

SINK Mode	ON (1)	OFF (0)
Driver	0 V Pulse	+V
/Driver	+V	0 V Pulse
SAC Mode	**ON (1)**	**OFF (0)**
Driver	+VPulse	0 V
/Driver	0 V	+V Pulse

Table 3-2 Device-Dependent Commands and Queries

Mnemonic	Description
Device Definition Commands:	
CREATE	**Syntax Summary:** CREATE devicename **Argument(s):** Devicename ASCII string, 12 character max length **Description:** Creates an ASCII virtual device name entry specifed by 'devicename' in the internal table of names. There are a max of 16 names allowed in the table, which is kept in non-volatile memory. A device name must be created before any other operations on the name are allowed. **Return value:** None **Example(s):** 'CREATE Stepatten'
DELETE	**Syntax Summary:** DELETE devicename **Argument(s):** Devicename ASCII string, 12 character max length **Description:** Deletes the device specified by 'devicename' from the internal table, removing its driver definitions. The deleted 'devicename' may no longer be referenced. **Return value:** None **Example(s):** 'DELETE Stepatten'
RENAME	**Syntax Summary:** RENAME oldname, newname **Argument(s):** oldname ASCII string, 12 character max length newname ASCII string, 12 character max length **Description:** Renames the device specifed by 'oldname' to the name given by 'newname'. The 'oldname' must specify an existing devicename. The 'newname' must not specify an existing devicename. **Return value**: None **Example**(s): 'RENAME Stepatten, 30dBstep'
APPEND	**Syntax Summary:** APPEND sourcename, targetname **Argument(s):** sourcename ASCII string, 12 character max length targetname ASCII string, 12 character max length **Description:** Appends the driver pin definitions from the device specified by 'sourcename' to the driver definitions of the device specified by 'targetname'. Both 'sourcename' and 'targetname' must specify existing device names. **Return value:** None **Example(s):** 'APPEND LW153-70, 70dB_step'
COPY	**Syntax Summary:** COPY sourcename, targetname **Argument(s):** sourcename ASCII string, 12 character max length targetname ASCII string, 12 character max length **Description:** Copies the driver pin definitions from the device specified by 'sourcename' to the driver definitions of the device specified by 'targetname', overwriting any currently existing driver definitions in the 'targetname' device. Both 'sourcename' and 'targetname' must specify existing device names. **Return value:** None **Example(s):** 'COPY LW153-70, 70dB_step'

Table 3-2. Device-Dependent Commands and Queries (Con't)

Mnemonic	Description
Device Definition Commands (Con't):	
LIST?	**Syntax Summary:** LIST? **Argument(s):** None **Description:** This cmd returns a list of all currently defined device names. **Return value:** The LIST? query function returns an ASCII string that contains up to 18 individual device names (16 user-definable plus 2 system names), each comprised of up to 12 characters in length. **Example(s):** 'LIST?' response: 'A, B, LW153-70, 70dB_step'
DEFINE	**Syntax Summary:** DEFINE devicename, pin_no, driver_type [, dbvalue] **Argument(s):** devicename ASCII string, 12 character max length pin_no integer, 1 to 16 driver_type ASCII string/integer. Refer to table below dbvalue real, 0.00 to 320.00 **Description:** Defines the parameters for a driver pin 'pin_no' for the device specified by 'devicename'. The 'devicename' must specify an existing device name. The 'pin_no' identifies the driver pin that is to be associated with the 'devicename', and may be any valid driver number from 1 to 16. The 'driver_type' parameter is used to specify the electrical mode of operation of the driver. Refer to table belows for valid codes and their meanings. The 'dbvalue' parameter may be used to assign a dB value to the driver pin, and may be any number in the range of 0.00 to 326.76, with a resulation of 0.01 dB. **driver_type TABLE** 'SINK', or 0 - current sink mode 'SCE', or 1 - current source mode 'PSINK', or 2 - pulsed-mode current sink 'PSCE', or 3 - pulsed-mode current source **Return value:** None **Example(s):** 'DEFINE LW153-70, 1, 0, 10.00' 'DEFINE LW153-70, 2, SINK, 40.00' 'DEFINE LW153-70, 3, 0, 20.00'
DEFINE?	**Syntax Summary:** DEFINE? devicename **Argument(s):** devicename ASCII string, 12 character max length **Description:** The DEFINE? query command is used to read the current driver pin definitions for the device specified by 'devicename'. **Return value:** The returning information consists of an integer count of the number of drivers that have been defined for the 'devicename', followed by a set of three parameters for each of the driver pins, specifying the driver pin number, driver type, and atten value. Refer to DEFINE cmd for the format of these parameters, and their meanings. **Example(s):** 'DEFINE? LW153-70' response: '3, 1, 0, 10.00, 2, 0, 40.00, 3, 0, 20.00'

Table 3-2. Device-Dependent Commands and Queries (Con't)

Mnemonic	Description
Device Definition Commands (Con't):	
PULSEWIDTH	**Syntax Summary:** PULSEWIDTH devicename, msec **Argument(s):** devicename ASCII string, 12 character max length msec integer, 0 to 32000 **Description:** Sets the pulse width duration time to 'msec' for the device specified by 'devicename'. The 'devicename' must exist. The pulse width can be any integer value up to a max of 32000 msec, and the resolution will be rounded to the nearest 10msec interval. This cmd is only meaningful for devices that have been defined to contain drivers configured for pulse-mode operation. **Return value:** None **Example(s):** 'PULSEWIDTH LW153-70, 20'
PULSEWIDTH?	**Syntax Summary:** PULSEWIDTH? devicename **Arguments(s):** devicename ASCII string, 12 character max length **Description:** Reads the current setting of the assigned pulsewidth for the device specified by 'devicename'. **Return value:** integer pulsewidth, in msec **Example(s):** 'PULSEWIDTH? LW153-70' response: '20'
DEFAULT	**Syntax Summary:** DEFAULT devname [,...] **Argument(s):** devname ASCII string, 12 character max length **Description:** Sets the default driver definitions that will be assigned to the driver pins on power-up. The main purpose of this cmd is to establish the configuration of the front-panel keys for local mode operation. **Return value:** None **Example(s):** 'DEFAULT LW153-70, LW150-11'
DEFAULT?	**Syntax Summary:** DEFAULT? **Argument(s):** None **Description:** Reads the current setting of the default driver definitions. **Return value:** ASCII string of the default device names. **Example(s):** 'DEFAULT?' response: 'LW153-70, WE150-11'
Device Programming Commands:	
SET	**Syntax Summary:** SET devname, setting **Argument(s):** devname ASCII string, 12 character max length setting integer, 0 to 65535 (definition dependant) **DESCRIPTION:** Programs the device specified by 'devname' to the integer value 'setting'. The 'devname' must specify an existing device name. The valid range of 'setting' is dependant upon the total number of driver pins that define 'devname', and is limited to the range of 0 to (2 ^ N)-1, where N = number of drivers. For example, if a device is defined to be controlled by 4 driver pins, then 'setting' can take the value 0 to 15. **Return value:** None **Example(s):** 'SET A 32'

Table 3-2. Device-Dependent Commands and Queries (Con't)

Mnemonic	Description
Device Programming Commands (Con't):	
SET?	**Syntax Summary:** SET? devname **Argument(s):** devname ASCII string, 12 character max length **Description:** The SET? cmd returns the current setting of the device specified by 'devname'. **Return value:** integer **Example(s):** 'SET? A' response: '32'
ATTN	**Syntax Summary:** ATTN devname, dbsetting **Argument(s):** devname ASCII string, 12 character max length dbsetting real number, 0.00 to 320.00 **Description:** Programs the device specified by 'devname' to the attenuation value represented by 'dbsetting'. The limits and resolution of 'dbsetting' are device-dependant (see ATTNLIMIT? cmd), however, the number must be less than 320.00, with a max resolution of 0.01 dB. This cmd is only valid if all drivers for 'devname' were DEFINEd with a 'dbvalue' parameter. **Return value:** None **Example(s):** 'ATTN LW153-70 30.00
ATTN?	**Syntax Summary:** ATTN? devname **Argument(s):** devname ASCII string, 12 character max length **Description:** Returns the attenuation setting of the device specified by 'devname'. **Return value:** real number **Example:** 'ATTN? LW153-70' response: '30.00'
ATTNLIMIT?	**Syntax Summary:** ATTNLIMIT? devname **Argument(s):** devname ASCII string, 12 character max length **Description:** Returns the valid min, max, and attenuation step values (in dB) for the device specified by 'devname'. **Return value:** real number min, real number max, real number step **Example(s):** 'ATTNLIMIT? LW153-70' response: '0.00, 70.00, 10.00'
General Purpose Commands:	
SAVE	**Syntax Summary:** SAVE **Argument(s):** None **Description:** The SAVE function allows the user to store all current device definitions into the non-volatile EEPROM memory. **Return value:** None **Example(s):** 'SAVE'
ERASE	**Syntax Summary:** ERASE accesscode **Arguments(s):** accesscode (Consult Factory) **Description:** The ERASE function is used to initialize the non-volatile EEPROM memory. The cmd is used primarily during manufacturing, and serves no useful purpose to the user. **Return value:** None

Table 3-2. Device-Dependent Commands and Queries (Con't)

Mnemonic	Description
General Purpose Commands (Con't:):	
RCL	**Syntax Summary:** RCL **Argument(s):** None **Description:** The RCL function allows the user to recall the device definitions that have been stored into the non-volatile memory. This function is performed automatically upon power-on. **CAUTION** The recalled device definitions will **OVERWRITE** any existing information that may have been programmed. **Return value:** None **Example(s):** 'RCL'
VER?	**Syntax Summary:** VER? **Argument(s):** None **Description:** Returns an ASCII string identifying the manufacturer, model number, and software revision level. **Return value:** ASCII string **Example(s):** 'VER?' response: 'Lucas Weinschel 8200, V1.00' **Argument(s):** inputselect character/integer 'A'or 1, 'B' or 2 **Description:** The IN? cmd reads the status of one of the optically-isolated input pins, and returns the pins' setting. The 'inputselect' identifies which of the two pins to read, and may take any of the following values: 'A', or 1 : read Port A input pin 'B', or 2 : read Port B input pin **Return value:** 0 or 1 **Example(s):** 'IN? A' response: '1'
PWR?	**Syntax Summary:** PWR? **Argument(s):** None **Description:** The PWR? cmd returns the settings of the internal Port Driver Voltage Selector switches. **Return value:** Port A voltage setting, Port B voltage setting. Each setting will be either 5, 12, or 24. **Example(s):** 'PWR?' response: '12, 24'
PA	**Syntax Summary:** PA address **Argument(s):** address integer, 0 to 65535 **Description:** Sets the target IO address for the diagnostic cmd 'PD'. Refer to Table 9-? for valid addresses and their functions. **Return value:** None **Example(s):** 'PA #H1000'

Table 3-2. Device-Dependent Commands and Queries (Con't)

Mnemonic	Description
General Purpose Commands (Con't):	
PA?	**Syntax Summary:** PA? **Argument(s):** None **Description:** Returns the setting of the current target address for IO read/write cmds via the 'PD' cmd. **Return value:** integer **Example(s):** 'PA?' response: '4096'
PD	**Syntax Summary:** PD data **Argument(s):** data integer, 0 to 255 **Description:** Sets the value 'data' at the target IO address previously specified by a 'PA' cmd. **Return value:** None **Example(s):** 'PD 255'
PD?	**Syntax Summary:** PD? **Argumeny(s)** none **Description:** Returns the setting of the current data value at the I/O target address previously specified by the 'PA' cmd. **Return value:** integer **Example(s):** 'PD?' response: '255'
GPIB Bus Management Commands:	
SRE	**Syntax Summary:** SRE mask **Argument(s):** mask integer, 0 to 255 **Description:** Sets an interrupt enable mask for the GPIB Status Byte Register. Bits specified with a logic 1 enable the ability to generate an SRQ, while a logic 0 prevents the bit from generating an SRQ. **Return value:** None **Example(s):** 'SRE 255'
SRE?	**Syntax Summary:** SRE? **Argument(s):** None **Description:** Returns the current setting of the SRE GPIB Status Register Enable mask. **Return value:** integer **Example(s):** 'SRE?' response: '255'
CLS	Syntax Summary: CLS **Argument(s):** None **Description:** Clears the GPIB Status Register. **Return value:** None **Example(s):** 'CLS'

Table 3-2. Device-Dependent Commands and Queries

Mnemonic	Description
GPIB Bus Management Commds (Con't):	
RST	**Syntax Summary:** None **Argument(s):** None **Description:** reset, (remove port definitions in RAM) **Return value:** None **Example(s):** None
ERR?	**Syntax Summary:** ERR? **Argument(s):** None **Description:** Returns an error code and brief description of the cause of a GPIB error. **Return value:** ASCII string **Example (s):** 'ERR?' response: '#H1011 : Cmd invalid.'
OPC	**Syntax Summary:** OPC **Argument(s):** None **Description:** Causes the 8200 to assert the OPC bit in the Status Byte Register upon completion of the current GPIB Program Message. Once asserted, the bit must be cleared via CLS' cmd. **Return value:** None **Example(s):** 'OPC'

Notes:

SECTION IV
DEVICE INSTALLATION AND SETUP

4-1 GENERAL.

This section contains installation and setup procedures for different types of devices that can be installed into the Model 8200 Controller.

4-2 DEVICE DESCRIPTION AND INSTALLATION.

The following paragraphs provide general description and installation instructions to use and install different devices into the Model 8200.

4-2.1 SERIES 3200 ATTENUATORS. This series of programmable attenuators is available in eight standard attenuation ranges and cell configurations. Each cell contains a standard TO-5 type double-pole, throw relay that provides a minimum loss attenuation path for the RF signal.

Microstrip circuitry and special compensation techniques produce fat attenuation verse frequency characteristics. The microstrip construction, using thick-flim circuit elements, assures product uniformity and minimizes special hand work usually required to achieve the performance specified. Excellent grounding is maintained through the use of gold-plated contact areas. This ensures minimum RF leakage and linearity over the full attenuation and frequency range. All 3200 Series Attenuators operate in the frequency range of dc to 2 GHz at a nominal characteristic impedance of 50 ohms. Table 4-1 provides the standard attenuation ranges, increments, and cell configurations.

Table 4-1. Model 3200 Series Configurations

Model Number	No. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3200-1	8	127/1	1, 2, 4, 8, 16, 32, and 64*
3200-1	8	63.75/0.25	1, 2, 4, 8, 16, 32, 0.5 and 0.25
3200-2	5	31/1	1, 2, 4, 8, and 16
3200-1	5	120/1	10, 20, 30, and 60**
3202	1	0.5/0.5	0.05***

* 64 dB cell comprised of two 32 cells.
** 60 dB cell comprised of two 30 cells.
*** Other dB values available.

Using Mounting Kit, P/N 193-1014 or P/N 193-1015 and IM-219 the 3200 Series Attenuator can be installed into the Model 8200. Mounting Kit P/N 193-1014 provides the necessary hardware and cabling to install one 3200 series into the Model 8200. If two 3200 Series Attenuators are desired use P/N 193-1015.

4-2.2 SERIES 3220 ATTENUATORS. This series of Latching Programmable Attenuators is available in five standard attenuation ranges and cell configurations. Each cell contains a DPDT magnetic latching RF relay that provides the switching action between characteristic zero and attenuation states.

Microstrip circuitry (same as 3200 Series) and special compensation techniques produce fat attenuation verse frequency characteristics. The microstrip construction, using thick-flim circuit elements, assures product uniformity and minimizes special hand work usually required to achieve the performance specified. Excellent grounding is maintained through the use of gold-plated contact areas. This ensures minimum RF leakage and linearity over the full attenuation and frequency range. All 3220 Series Attenuators operate in the frequency range of dc to 2 GHz at a nominal characteristic impedance of 50 ohms.

Since the control configuration is latching, there is no continuous dc power drain through the relay coils. Consequently the attenuator's stability and contact repeatability are more efficient compared to the non-latching types of attenuators. Table 4-2 provides the standard attenuation ranges, increments, and cell configurations.

Table 4-2. Model 3220 Series Configurations

Model Number	No. Cells	Attenuation Range/Steps (dB)	Cell Increments (dB)
3220-1	8	127/1	1, 2, 4, 8, 16, 32, and 64*
3221-1	5	31/1	1, 2, 4, 8, and 16
3221-2	5	120/1	10, 20, 30, and 60**

* 64 dB cell comprised of two 32 cells.
** 60 dB cell comprised of two 30 cells.

Using Mounting Kit, P/N 193-1016 or P/N 193-1017 and IM-219 the 3200 Series Attenuator can be installed into the Model 8200. Mounting Kit P/N 193-1016 provides the necessary hardware and cabling to install one 3220 series into the Model 8200. If two 3200 Series Attenuators are desired, use P/N 193-1017.

4-2.3 SERIES 150, 160, and 170 ATTENUATORS. This series of Programmable Step Attenuators represents the widest range of programmable attenuators available. These attenuators can provide programmable adjustments of RF signal levels in very precise steps of 1 dB, 5 dB, 10 dB, or higher if required. Each attenuator consists of a cascaded assembly of switched attenuator cells (Figure 4-1). The attenuator elements located in the attenuator cell are created using a proprietary thin film process which ensures exceptional long-term stability, low power and temperature coefficients. This series of Programmable Step Attenuators uses an electromechanical switching structure that provides rapid switching together with low insertion loss. Table 4-3 provides the standard attenuation ranges, increments, and cell configurations.

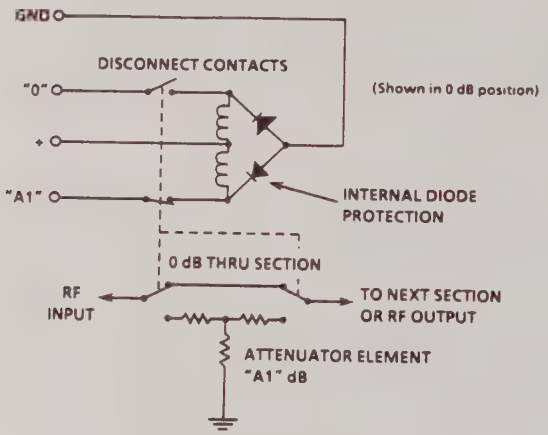


Figure 4-1. Typical Attenuator Cell Schematic

All of the 150, 160, and 170 Series Attenuators will operate within the three different frequency ranges of dc to 4 GHz, dc to 18 GHz, or dc to 26.5 GHz at a nominal characteristic impedance of 50 ohms.

Using Mounting Kit, P/N 193-1012 or P/N 193-1013 and IM-219 the 150, 160, 170 Series Attenuators can be installed into the Model 8200. Mounting Kit P/N 193-1012 provides the necessary hardware and cabling to install one 3200 Series into the Model 8200. If two 150, 160, and/or 170 Series Attenuators are desired, use P/N 193-1013.

4-3 DEVICE DEFINITION OVERVIEW.

A virtual device is created in the following manner. First, a name is defined via the CREATE command. This clears a data structure for the device and makes the name available for further operations. If the name is already in use, or the 16-name limit is exceeded, an error is generated to the user. The device name given in the CREATE command may be any combination of ASCII upper or lower case alpha characters ('A'-'Z', 'a'-'z'), numeric digits ('0'-'9'), and the following punctuation characters: '-' (2Dh), '/' (2Fh), '\' (5Ch), and '_' (5Fh), with a length of up to twelve characters. Examples of valid device names include "STEP", "3220-1", "70DB", "Pin sw", etc.

Once a device name has been created, the driver pins that are used to control the device must be individually defined, via use of the DEFINE command. This command allows the user to describe the physical connection between the Model 8200 and the device, the electrical characteristics required to interface to the device, and allows the user to assign an attenuation value to each of the driver pins, giving the user the ability to program the device directly in terms of attenuation instead of having to specify individual bit values for each of the drivers. Defining a device in this manner allows some additional benefits. Since the individual drivers that are used to control a device are specified by the user, the physical connections between a device and the Model 8200 does not require that the drivers be selected in a contiguous manner. This is useful when adding another device in the future, as you may select an available unused driver to control the device. When controlling a device's setting (via the GPIB the SET or ATTN commands), you do not need to worry about the physical driver connection to your device, as the Model 8200 will translate the programming information and send it to the appropriate driver(s) for the device. You only need deal with the RANGE of values that are appropriate for the device under control. For example, a device controlled by a single line has two valid settings (0 or 1). It does not matter if the device is connected to Driver 1, Driver 5, or Driver 16. Simply send the device 0 or 1. The user does not have to perform any scaling or bit-manipulations to put the data in the proper position. In general, a device controlled by N drivers will have a programming range from 0 to (2^N)-1, assuming all settings are valid for the device. Once a device has been defined, its definition may be stored in non-volatile memory for future reference via the GPIB 'SAVE' command.

Driver type configurations for LOCAL mode of operation via the front panel are handled in two different manners. An internal DIP switch allows the user to select the electrical mode of operation for each port as a group of eight driver pairs. A more flexible method is to establish a default driver configuration via the GPIB 'DEFAULT' command. This command lists which of the driver definitions contained in the non-volatile memory that should be assigned to the front panel keys upon power-up. Note that the DIP switch setting, if used, will override any default definitions that have been stored. To enable the DEFAULT definitions, all sections of the switch must be set to the OFF position. Refer to examples and configurations located in paragraph 4-7 as an aid in configuring your devices!

4-4 CONFIGURING VOLTAGE SELECTOR SWITCHES (A3S1 and A3S2).

Each Device Port (A and B) contains a Voltage Selector Switch (located on the Driver PCB Assembly (A3) that sets the operational voltage for each of the eight drivers contained in the Device Port. Using the following procedures will ensure that the Voltage Selector Switch(s) are set to the desired operational voltage for each device to be installed in the Model 8200.

Table 4-3. Series 150, 160, and 170 Cell Configuration

ATTN Range	Comments	CELL 1		CELL 2		CELL 3		CELL 4	
		Bypass	Attenuator Element	Bypass	Attenuator Element	Bypass	Attenuator Element	Bypass	Attenuator Element
11 dB		0 dB	1 dB	0 dB	4 dB	0 dB	2 dB	0 dB	4 dB
15 dB		0 dB	1 dB	0 dB	8 dB	0 dB	2 dB	0 dB	4 dB
55 dB		0 dB	5 dB	0 dB	10 dB	0 dB	20 dB	0 dB	20 dB
70 dB	4 CELL	0 dB	10 dB	0 dB	20 dB	0 dB	20 dB	0 dB	20 dB
	3 CELL	0 dB	10 dB	0 dB	40 dB	0 dB	20 dB	---	---
75 dB		0 dB	5 dB	0 dB	40 dB	0 dB	20 dB	0 dB	10 dB
90 dB		0 dB	10 dB	0 dB	30 dB	0 dB	20 dB	0 dB	30 dB
110 dB		0 dB	10 dB	0 dB	40 dB	0 dB	20 dB	0 dB	40 dB
130 dB		0 dB	10 dB	0 dB	60 dB	0 dB	20 dB	0 dB	40 dB
CONN PIN #*	Round	5	6	9	10	7	8	11	12
Color Code	Round	Purple	Yellow	Orange	Blue	Black	Green	Brown	White

* NOTE: PIN 1: +24 V OR +5 V CONTROL VOLTAGE (RED)
PIN 2: GND (GRAY)

a. Ensure POWER has been removed from the Model 8200 before attempting to change the Voltage Selector Switch(s).

b. Remove two screws attaching the top cover to the Model 8200. Carefully slide the top cover towards the rear of the instrument until removed.

c. Using Figure 9-6, locate the Voltage Selector Switches (A3S1 for Device Port A and A3S2 for Device Port B) located on the Driver PCB Assembly.

CAUTION

- **DO NOT** change the settings of the Voltage Selector Switch(s) with **POWER** applied.
- This Voltage Selector Switch must be set to match the device being controlled; select one from +5, +12, or +24V operation.
- If controlling more than one device per Port, the devices must have the same operational voltage.

d. Set the Voltage Selector Switch(s) to the desired voltage setting (setting must match the device's operational voltage).

e. Carefully slide top cover into Model 8200 and secure using two screws previously removed.

f. Connect Model 8200 to external power source.

4-5 SETTING DRIVER TYPES.

The driver types are selectable for Device Port A and B using the Driver Type Selection switch (S3) located on the Driver PCB Assembly, as well as using the GPIB configuration commands. Using the following procedures will ensure that the Driver Type Selection switch is set to the appropriate driver types for each of the devices to be installed in or connected externally to the Model 8200.

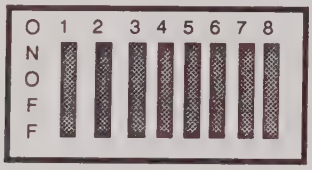
CAUTION

The Driver Selection Switch must be set before power is applied. Changing the position of this switch after power is applied will not affect the operation of the Model 8200.

a. Ensure POWER has been removed from the Model 8200 before attempting to change the Drive Type Selection Switch(s).

b. Remove two screws attaching the top cover to the Model 8200. Carefully slide the top cover towards the rear of the instrument until removed.

c. If using GPIB configuration commands, go to step 'd'. When using the local mode of operation, the Driver Type Selection Switch sets the power-on default driver types for ports A and B. This switch contains eight selection switches, four for each port (A and B). Using Figure 4-2, select only one of SRC, or SINK by placing the switch in the ON position and the other two switches to the OFF position. In addition, set the PULSE switch to the desired setting: ON for pulse operation, OFF for steady-state.



Switch 1 - Pulse mode (Port A)
Switch 2 - SCE (Port A)
Switch 3 - SINK (Port A)
Switch 4 - Not Used
Switch 5 - Pulse mode (Port B)
Switch 6 - SCE (Port B)
Switch 7 - SINK (Port B)
Switch 8 - Not Used

Figure 4-2. Driver Type Selection Switch

d. If using the GPIB configuration commands to control the power-on setting of the driver types, place all four switches for each port to the OFF position. When using the remote mode of operation, all driver type information for user-defined devices, as well as ports A and B, may be taken from the configuration programming information provided when a device is created.

e. Carefully slide top cover into Model 8200 and secure using two screws previously removed.

4-6 DRIVER PIN OUTPUT OPERATIONAL SETTINGS.

The following lists describe how the driver pins function electrically for each of the three operational modes. +V equals the voltage of the respective port, as chosen by the port's Voltage Selector Switch (+5, +12, +24) located on the Driver PCB Assembly. The notation 'passive' indicates that a driver is inactive and is neither in the Sinking or Sourcing Current modes.

CONTINUOUS OPERATION:

SINK Mode	ON (1)	OFF (0)
Driver	0 V	+V
/Driver	+V	0 V
SCE Mode	**ON (1)**	**OFF (0)**
Driver	+V	0 V
/Driver	0 V	+V

PULSE MODE:

SINK Mode	ON (1)	OFF (0)
Driver	0 V Pulse	+V
/Driver	+V	0 V Pulse
SCE Mode	**ON (1)**	**OFF (0)**
Driver	+VPulse	0 V
/Driver	0 V	+V Pulse

4-7 EXAMPLE CONFIGURATIONS.

The following paragraphs provide different types of example configurations and uses for the Model 8200. These examples can be used as a guide line for setting up the devices listed in the examples or any other devices the user may want to control using the Model 8200.

4-7.1 CONFIGURING A LWI MODEL 3200 SERIES ATTENUATOR. In this following example we will install and setup a LWI Model 3200-2. The 3200-2 is a programmable step attenuator with the following characteristics:

- Frequency Range: dc-2 GHz
- Eight attenuation sections (cells), providing an attenuation range of 0-63.75 dB in 0.25 dB steps.
- Operating Voltage: +12 V
- Switching Type: continuous
- Driver Type required: source
- Each cell contains individual control lines that operate as follows:

  1. When the control signal equals 0 V, the cell is turned OFF (bypass).

  2. When the control signal equals +12 V, the cell is turned ON (atten).

a. If desired, install step attenuator into Model 8200 using paragraph 4-2.1.

b. Set Device Port A Voltage Selector Switch(A3S1) to +12 V (paragraph 4-6).

c. Set Device Port A driver mode to countinuos source by placing the Driver Types section switch (paragraph 4-7) as follows:

Switch 1	OFF
Switch 2	ON
Switch 3	OFF
Switch 4	OFF

d. Connect the step attenuator wiring to Device Port A drivers 1 thru 8 using the following:

Device Control	Pin Driver	Rear-Panel (J1)	Internal (J5)
GND	--	4,17	7,8
Cell 1 (0.25dB)	1	25	24
Cell 2 (0.5 dB)	2	12	23
Cell 3 (1dB)	3	24	22
Cell 4 (2dB)	4	11	21
Cell 5 (4dB)	5	23	20
Cell 6 (8dB)	6	10	19
Cell 7 (16dB)	7	22	18
Cell 8 (32dB)	8	9	17

e. If desired the step attenuator can now be operated in the local mode (manual) using paragraphs 3-2 and 3-3. If the Remote mode of operation is desired refer to step 'f' to configure the GPIB bus to control the Model 3221-2.

f. To configure the Model 8200 to control the Model 3221-2 using the GPIB commands as follows:

(Assuming a user-defined name of 'LW3200-2')

CREATE	LW3200-2
DEFINE	LW3200-2, 1, SCE, 0.25
DEFINE	LW3200-2, 2, SCE, 0.5
DEFINE	LW3200-2, 3, SCE, 1.0
DEFINE	LW3200-2, 4, SCE, 2.0
DEFINE	LW3200-2, 5, SCE, 4.0
DEFINE	LW3200-2, 6, SCE, 8.0
DEFINE	LW3200-2, 7, SCE,16.0
DEFINE	LW3200-2, 8, SCE,32.0

4-7.2 CONFIGURING A LWI MODEL 3220 SERIES ATTENUATOR. In this following example we will install and set up an LWI Model 3221-2. The 3221-2 is a step Attenuator with the following characteristics:

- Frequency Range: dc-2 GHz
- Five attenuation sections (cells), providing an attenuation range of 0-120 dB in 10 dB steps.
- Operating Voltage: +12 V
- Switching Type: pulsed, 10 msec
- Driver Type required: source
- Each cell contains a sperate ON and OFF input control line (10 controls total).

NOTE

The Model 3221-2 has a step of 60 dB, that is attained by connecting two 32 dB cells together.

a. If desired, install step attenuator into Model 8200 using paragraph 4-2.2.

b. Set Device Port A Voltage Selector Switch (A3S1) to +12 V (paragraph 4-6).

c. Set Device Port B driver mode to pulsed source by placing the Driver Types section switch (paragraph 4-7) as follows:

Switch 5	ON
Switch 6	ON
Switch 7	OFF
Switch 8	OFF

d. Connect the step attenuator wiring to Device Port B drivers 9 thru 12 using the following:

Device Control	Pin Driver	Rear-Panel (J1)	Internal (J5)
GND	--	4,17	7,8
Cell 1 (30dB)			
atten (on)	9	25	24
bypass (off)	/9	21	16
Cell 2 (10dB)			
atten (on)	10	12	23
bypass (off)	/10	8	15
Cell 3 (30dB) **			
atten (on)	1	24	22
bypass (off)	/11	20	14
Cell 4 (20dB)			
atten (on)	12	11	21
bypass (off)	/12	7	13
Cell 5 (30dB) **			
atten (on)	11	4	22
bypass (off)	/11	20	14

** ganged together to create a 60 dB cell

e. If desired the step attenuator can now be operated in the local mode (manual) using paragraphs 3-2 and 3-3. If the remote mode of operation is desired, refer to step 'f' to configure the GPIB bus to control the Model 3200-2.

f. To configure the Model 8200 to control the Model 3221-2 using the GPIB commands as follows:

(Assuming a user-defined name of 'LW3221-2')

CREATE	LW3221-2
DEFINE	LW3221-2, 9, PSCE, 30.00
DEFINE	LW3221-2,10, PSCE, 10.00
DEFINE	LW3221-2,11, PSCE, 60.00
DEFINE	LW3221-2,12, PSCE, 20.00
PULSE WIDTH	LW3221-2 20

4-7.3 CONFIGURING LWI Model 150, 160, and 170 SERIES ATTENUATORS. In the following example we will install and setup a LWI Model 150-11. The 150-11 is a Step Attenuator with the following characteristics:

- Frequency Range: DC-18 GHz
- Four attenuation sections (cells), providing an attenuation range of 0-11 dB in 1 dB steps.
- Operating Voltage: +24 V
- Switching Type: latching, 20 msec
- Driver Type required : sink, or pulsed sink
- Each cell contains a separate ON and OFF input control line (eight controls total).

a. If desired, install step attenuator into Model 8200 using paragraph 4-2.3 (If not previously installed).

b. Set Device Port A Voltage Selector Switch (A3S1) to +24 V (paragraph 4-6).

c. Set Device Port A driver mode to pulsed sink by placing the Driver Types section switch (paragraph 4-7) as follows:

Switch 1	ON
Switch 2	OFF
Switch 3	ON
Switch 4	OFF

d. Connect the step attenuator wiring to Device Port A drivers 1 thru 4 using the following:

Device Control	Pin Driver	Rear-Panel (J1)	Internal (J5)
Power +24 V	1 (red)	3,16	5,6
GND	2 (gray)	4,17	7,8
Cell 1 (1 dB)			
atten (ON)	6 (yel)1	25	24
bypass (OFF)	5 (pur)/1	21	16
Cell 2 (4 dB)			
atten (ON)	10 (blue)2	12	13
bypass (OFF)	9 (orange)/2	8	15
Cell 3 (2 dB)			
atten (on)	8 (green)3	24	22
bypass (off)	7 (black)/3	20	14
Cell 4 (4 dB)			
atten (on)	12 (white)4	11	21
bypass (off)	11 (brown) /4	7	13

e. If desired the step attenuator can now be operated in the local mode (manual) using paragraphs 3-2 and 3-3. If the remote mode of operation is desired, refer to step 'f' to configure the GPIB bus to control the Model 150-11.

f. To configure the Model 8200 to control the Model 3200-2 using the GPIB commands as follows:

(Assuming a user-defined name of 'LW150-11')

CREATE	LW150-11
DEFINE	LW150-11, 1, SINK, 1.0
DEFINE	LW150-11, 2, 1, 4.0
DEFINE	LW150-11, 3, 1, 2.0
DEFINE	LW150-11, 4, 1, 4.0
PULSE WIDTH	LW150-11, 20

4-7.4 CONFIGURING OTHER DEVICES. The Model 8200 can also control various type of devices other than step attenuators. In this example we will install a generic device (such as a relay, electromechanical switches, or any other TTL compatible components).

NOTE

When installing the generic device into the Model 8200, position the device onto the attenuator mounting plate so that the device can be secured using the maxminum possible number of screws.

a. If desired, install the generic device into Model 8200 using paragraph 4-2.1 as a guideline for installing any device. Note that the device can be operated externally by using Device Ports A and B located on the rear of the Model 8200.

b. Connect the generic device wiring to Device Port A or B using Tables 4-4 and 4-5.

Table 4-4. Device Port A Signal Designators

Signal Name	Rear Panel Connector (A2J1) Pin No.	Internal Connector (A2J5) Pin No.
+5 V	1	1
+5 V	14	2
+12 V	2	3
+12 V	15	4
+24 V	3	5
+24 V	16	6
GND	4	7
GND	17	8
/DRIVER1	21	16
/DRIVER2	8	15
/DRIVER3	20	14
/DRIVER4	7	13
/DRIVER5	19	12
/DRIVER6	6	11
/DRIVER7	18	10
/DRIVER8	5	9
DRIVER1	25	24
DRIVER2	12	23
DRIVER3	24	22
DRIVER4	11	21
DRIVER5	23	20
DRIVER6	10	19
DRIVER7	22	18
DRIVER8	9	17
/IN_A	13	25

Table 4-5. Device Port B Signal Designators

Signal Name	Rear Panel Connector (A2J2) Pin No.	Internal Connector (A2J6) Pin No.
+5 V	1	1
+5 V	14	2
+12 V	2	3
+12 V	15	4
+24 V	3	5
+24 V	16	6
GND	4	7
GND	17	8
/DRIVER9	21	16
/DRIVER10	8	15
/DRIVER11	20	14
/DRIVER12	7	13
/DRIVER13	19	12
/DRIVER14	6	11
/DRIVER15	18	10
/DRIVER16	5	9
DRIVER9	25	24
DRIVER10	12	23
DRIVER11	24	22
DRIVER12	11	21
DRIVER13	23	20
DRIVER14	10	19
DRIVER15	22	18
DRIVER16	9	17
/IN_B	13	25

CAUTION

- **DO NOT** change the settings of the Voltage Selector Switch(s) with **POWER** applied.
- This Voltage Selector Switch must be set to match the device operational voltage.
- If controlling more than one device per Port, the devices must have the same operational voltage.

c. Set Device Port A or B Voltage Selector switch(A3S1 or A3S2) to +5 V, +12 V, or +24 V (refer to paragraph 4-6).

CAUTION

- The Driver Selection Switch must be set before power is applied. Changing the position of this switch after power is applied will not affect the operation of the Model 8200.
- If controlling more than one device per Port, the devices must have the same operational characteristics.

d. Using the Driver Type Selection switch, set the Driver Types for the generic device to be controlled by either Device Port A or B (refer to paragraph 4-7).

e. If desired the generic device can now be operated in the local mode (manual) using paragraphs 3-2 and 3-3. If the Remote mode of operation is desired, refer to step 'f' to configure the GPIB bus to control the device.

f. Using the GPIB commands located in Table 3-2, configure the Model 8200 to control the generic device(s).

4-7.5 COMBINING DEVICES. Assume that we have two step attenuators, a Model 3201-4 and a Model 151-11, that we wish to gang together to create an attenuator with a wider range and smaller step size. We also desire the ability to program the new device via the GPIB bus directly in terms of attenuation values, as well as being able to access each attenuator separately.

The 3201-4 is a step attenuator with the following characteristics:

- Four attenuation sections (cells), providing an attenuation range of 0-1.2 dB in 0.1 dB steps
- Operating voltage : +12 V
- Continuous control signal required (non-latching).
- SCE driver type (cells require an application voltage to engage; they have a common return).
- Individual cell atten values - section 1 - 0.1 dB, section 2 - 0.2 dB, section 3 - 0.3 dB, section 4 - 0.6 dB.

The 151-11 is a step attenuator with the following characteristics:

- Four attenuation sections (cells), providing an attenuation range of 0-11 dB in 1 dB steps.
- Operating voltage : +24 V
- Pulse control signal required (latching). Minimum pulse width: 20 msec
- SINK driver type (cells required application of gnd to engage; they have a common voltage)
- Individual cell attenuation values - section 1 - 1 dB, section 2 - 4 dB, section 3 - 2 dB, section 4 - 4 dB.

Because of the different control voltage requirements, configure Device Port A for +12 V operation, and Device Port B for +24V operation using the Voltage Selector switches. We will use the first four driver pins of of each port to control the devices.

Configure the Model 8200 using the following GPIB commands:

```
CREATE      LW3201-4
DEFINE      LW3201-4, 1, SCE, 0.1
DEFINE      LW3201-4, 2, 1, 0.2
DEFINE      LW3201-4, 3, 1, 0.3
DEFINE      LW3201-4, 4, 1, 0.6

CREATE      LW151-11
DEFINE      LW151-11, 9, PSINK, 1.0
DEFINE      LW151-11, 10, 2, 4.0
DEFINE      LW151-11, 11, 2, 2.0
DEFINE      LW151-11, 12, 2, 4.0
PULSEWIDTH  LW151-11, 20

CREATE      Atten1
COPY        LW3201-4 Atten1
APPEND      LW151-11 Atten1
```

We have created an 8-cell virtual device consisting of a 4-cell Model 3201-4 (0-1.2/.1 dB) attenuator (using drivers 1-4), and a 4-cell Model 151-11 (0-11/1 dB) attenuator (using to drivers 9-12). The device is named 'Atten1', and has a range of 0-12.2 dB in 0.1 dB steps. The device may be programmed directly in attenuation values using the ATTN command, or in bit-patterns using the SET command.

SECTION V
THEORY OF OPERATION

5-1. GENERAL.

This section contains the theory of operation for the Model 8200 Controller. The section explains the principles upon which the Model 8200's design is based and provides a systematic explanation of the Controller's circuitry.

5-2 MODEL 8200 CIRCUIT DESCRIPTION.

The following paragraphs provide a detailed circuit description and block diagrams of the Model 8200.

5-2.1 OVERALL OPERATION. The Model 8200 Controller contains internal circuitry necessary to control a variety of programmable attenuators, relays, electromechanical switches, or TTL compatible devices via either front panel or IEEE-488 GPIB operation. This instrument can provide the user with a multitude of circuit configurations. Figure 4-1 provides a simplified block diagram of the Controller's internal circuitry. The Controller primarily consists of four circuit groups consisting of a Power Supply Section, Status Displays and Selector Keys Section, a CPU Section, and an Output Driver Section, which are used to control two electrically and logically configurable output ports (Device Ports A and B).

5-2.2 POWER SUPPLY SECTION. The Model 8200 contains a high-efficiency switching type Power Supply Assembly (A3) which will operate with either a 90 to 130 Vac or 180 to 250 Vac input power source. The input power source is routed thru the Power Entry Module Assembly (XF1) before being applied to the Power Supply Assembly. The Power Entry Module Assembly allows the user to select between the two operational voltage ranges that can be accepted by the Power Supply Assembly.

This Switching Power Supply provides the Model 8200 with an adjustable $+5 \pm 0.25$ V @ 2 A output and a $+24 \pm 1.2$ V @ 1 A output. These outputs are then routed to the Driver PCB Assembly for distribution to the other assemblies located in the Model 8200. Performing any adjustment of the +5 V supply will cause the +24 V supply to rise or fall proportionally. The Power Supply Assembly also contains overload protection circuitry to reduce the output levels when the output power exceeds 150% of the rated value, thus protecting all outputs. Figure 9-2 shows the actual power distribution for all assemblies and modules located in the Model 8200.

A +12 V supply is produced by routing the +24 V through the Driver PCB Assembly to a Voltage Regulator (U1). The output of the regulator is routed back to the Driver PCB Assembly to be applied to the Voltage Selector Switches (A2S1 and A2S3).

5-2.3 STATUS DISPLAYS AND SWITCH CONTROL SECTION. This Switch/LED Status PCB Assembly (A4) (Refer to Figure 9-7) located behind the the front panel contains a group of LED's (DS18 through DS36) that indicates the status of the GPIB bus operation and the defined operating parameters of Device Ports A and B. The Switch/LED Status PCB Assembly also contains control switches (S1 through S18) which are used to set the GPIB address information, program the selected Device Port, select the mode of operation (Local or Remote) and manually control devices connected to the Model 8200. These control switches operate in a toggle fashion, ie, push for ON and push for OFF. Refer to paragraph 3-2 for an operational description of each LED and switch located on the front panel of the Model 8200.

5-2.4 CPU SECTION. The CPU section consists of a microprocessor-based circuit card assembly (A1) responsible for programming and control of the Driver PCB Assembly, GPIB bus operation, and front panel Switch/LED control. Refer to Figure 9-4 as an aid in understanding the following discussions. This circuit card can be divided into five subsections, as follows:

- Processor Section
- Memory Section
- GPIB Bus Section
- Display Control Section
- Keyboard Interface Section
- Analog I/O Section

5-2.4.1 Processor Section. The Processor Section is comprised of U1 (80C188-12 CMOS 16-bit Microprocessor), U2 (ICL8211 Voltage Reference/Detector), U3 (74ACT573 Octal Transparent Latch), A1U17 (74ACT245 Bus Transceiver), and A1Y1 (Clock Oscillator).

The 80C188 MPU (U1) is a high-integration 16-bit microprocessor that controls operation of the system address and data busses, memory and I/O chip select logic, bus control signals, management of the digital system interrupts, and 3 counter/timers. The MPU's basic timing is derived from Y1, a 24MHz CMOS clock oscillator IC, dividing Y1's output frequency by 2 to provide a system clock (SCLK) of 12MHz. This gives the MPU a single clock cycle time (one Tstate) of 83 nsec (1/12MHz), producing no wait state bus cycle times of 332 nsec (4 x Tstate) for memory and I/O accesses. Power-ON reset timing for the 80C188 is controlled by U2 (ICL8211) which is a programmable voltage detector. Internally, U2 consists of a voltage reference, a comparator, and an open-drain output driver. The detector is programmed via the voltage divider set-up

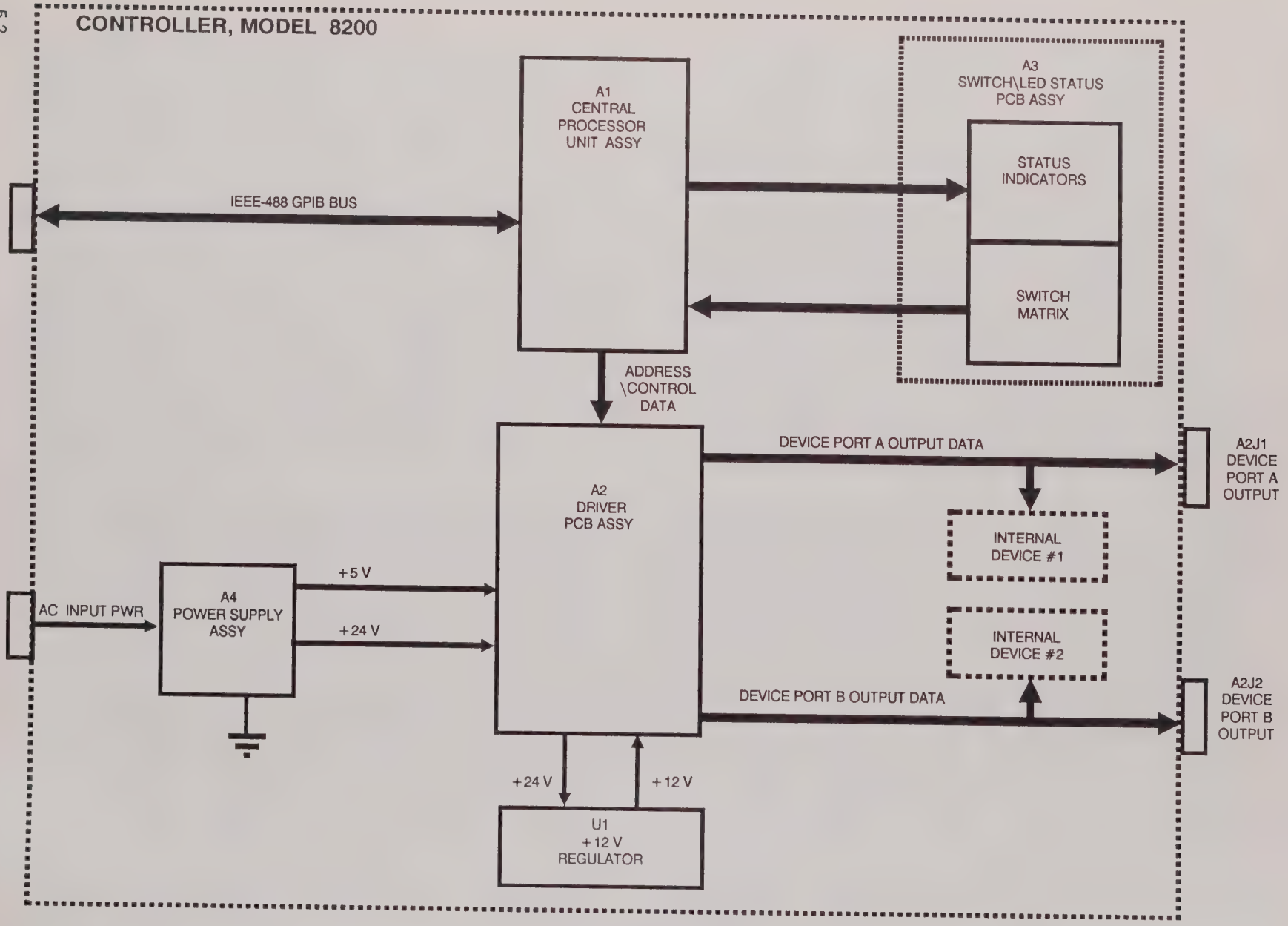


Figure 5-1. Model 8200 Block Diagram

by resistors R1 and R2 to hold the MPU's reset input pin /RES low when Vcc power is below +4.6 V. Switch S1 provides a manually operated reset function to the MPU.

The MPU generates the system address and data busses from the A15-A8 and AD7-AD0 signals. The 8-bit data bus and the lower half of the address bus are time multiplexed on the AD7-AD0 pins. U3 (74ACT573 octal latch) serves to demultiplex and latch the address information under control of the MPU generated ALE signal, which is provided at the beginning of each bus cycle. The A7-A0 address information is latched on the falling edge of the ALE signal, where it remains for the duration of the current processor bus cycle. U17 (74ACT245 bus transceiver) controls the data bus flow and provides additional drive for the MPU's data bus via the DT/R direction control and /DEN data enable signals. Additional bus control signals are generated by the MPU, including /RD (read) and /WR (write).

The CPU PCB Assembly contains an expansion bus connector (J6) that provides the system address/data bus, chip select, and control signals for interfacing to other cards. Table 5-1 lists the signal designators for the signal present at each contact pin.

5-2.4.2 Memory Section. The memory section is comprised of 32k bytes of EPROM (U5 27C256), 32k bytes of static RAM (U6 43256), and 2k bytes of non-volatile EEPROM (U11 24C16 serial EEPROM). This CPU PCB Assembly contains provisions for expanding the available memory via movable jumpers.

The system firmware resides in the U5 EPROM, whose data output is valid when the /RD output enable and /UCS chip select signals are at a logic low. The 28 pin socket containing U5 is configurable via jumper JB2 to allow insertion of either a 32k x 8 (27256 type, JB2 1-2), or a 64kX8 (27512 type , JB2 3-4) or EPROM devices.

Program variables and stack are located in U4, a static RAM, whose data is under the control of the /RD output enable, /WR write enable, and /LCS chip select signals. The jumper JB1 configures the 28 pin socket of U4 to accept either 8k x 8 (6264 type, JB1 1-2) or 32k x 8 (62256 type, JB1 3-4) RAM devices.

This CPU PCB Assembly provides for up to 4k bytes of non-volatile memory, in the form of EEPROM. Two eight-pin sockets are provided (U11 and U21) that will accept either 512 x 8 (24C04 type) or 2k x 8 (24C16 type) devices. These memory devices contain a two wire serial data interface to the MPU. Operation of the serial interface to the EEPROM is mapped into the MPU's I/O address space, and is under microprocessor control. Portions of U10 (22V10 PAL) provide the logic for interfacing both the data (SDA) and clock (SCLK1 and SLK2) signals to the EEPROMs (Refer to Table 5-2 for I/O map for addresses).

Signals			Description
/UCS	/RD	/WR	
1	1	X	U5 EPROM not selected
0	0	X	Read data from EPROM
/LCS	/RD	/WR	
1	1	X	U4 RAM not selected
0	0	1	Read data from RAM
0	1	0	Write data to RAM

5-2.4.3 GPIB Bus Section. The IEEE-488 (GPIB) bus group is comprised of U7 (7210 GPIB Talker/Listener/Controller), U8 (SN75160B bus transceiver), U9 (SN75161B bus transceiver), and a portion of U22 (74ACT573 octal latch). The 7210 operates under processor control to provide all interface handshake and data transfer functions, while U8 and U9 provide the electrical interface to the rear panel GPIB connector.

Data transfers to and from the 7210 operate under the control of the MPU generated /PCS0 (chip select), /RD (read) and /WR (write) control signals (Refer to Table 5-2, I/O map for addresses). The 7210 is programmed to operate in an interrupt-driven mode, asserting the INTR0 interrupt signal to the MPU to a high level when an enabled event occurs.

The 7210 may be configured to operate as a bus controller under direction of the processor by writing a low to bit 6 of the output port contained on the CPU PCB Assembly (U22 74ACT573, pin 13). The 74ACT573 is a transparent latch controlled by the OP_LE latch enable signal generated by a pal (U10 22V10). Normal Talk/Listen mode is set active when a logic one is programmed at this pin.

Signals					Description
/PCS0	/RD	/WR			
1	X	X			7210 not selected
0	0	1			Read data from 7210
0	1	0			Write data to 7210
/PCS	2A	1	A0	/WR	
1	X	X	X	X	Output latch not selected
0	0	1	0	0	Write output latch data (OP_LE = D6)

5-2.4.4 Display Control Section. This CPU PCB Assembly provides control logic for three different types of displays: an ASCII dot-matrix display module, scanned-matrix LEDs (up to 4 rows of eight columns), and six dedicated I/O port lines for driving LED's.

Table 5-1. Expansion Bus Connector, J6 Pin Assignments

Symbol	Pin No.	Type	Function
ADC_IN	1	I	Analog signal input to the A to D Converter.
DAC_OUT	3	O	Analog signal output from the D to A Converter.
/PCS5 /PCS6	5 6	O O	Peripheral Chip Select signals 5 & 6 are active LOW when a reference is made to the defined peripheral area.
/MCS1 /MCS0	7 8	O O	Memory Chip Select signals are active LOW when a memory reference is made to the defined portion of memory.
AD0 - AD7	9-16	I/O	Address/Data Bus (0-7) signals constitute the time multiplexed memory or I/O address and data bus.
RESET	17	O	Reset Output indicates that the 80C188 CPU is being reset. It is an active HIGH signal, and lasts an integer number of clock periods corresponding to the length of the PWROK signal.
PWROK	18	O	Power OK provides an indication that the +5 volt system power supply has reached a level of 4.6 volts. It is an active HIGH signal.
INTR2	19	I	A Maskable Interrupt Request can be requested by activating this pin. The pin is active HIGH, and may be configured to be either edge- or level-triggered.
NMI	20	I	A Non-Maskable Interrupt is initiated by a LOW to HIGH transition of this pin. NMI must be asserted for at least one clock.
SCLK	21	O	System Clock Out provides the system with a 50% duty cycle waveform, at a frequency of 1/2 the CPU input clock.
ALE	22	O	Address Latch Enable is provided to latch the address information on the AD0-AD7 pins. ALE is active HIGH.
/WR	23	O	Write strobe indicates that the data on the bus is to be written into a memory or an I/O device. The signal is active LOW.
/RD	24	O	Read strobe is an active LOW signal which indicates that the processor is performing a memory or an I/O read cycle.
/DEN	25	O	Data Enable is provided as a data bus transceiver output enable. The signal is active LOW during each memory and I/O access.

Table 5-2. CPU PCB Assembly I/O Address Map

Signal	MPU Address	Input Output /Memory	Function
/LCS	00000h-07FFFh	M	U4 RAM Chip Select (8K/32Kx8)
/UCS	F0000h-FFFFFh	M	U5 EPROM Chip Select (32K/64Kx8)
/MCS0	unassigned	M	XBUS Expansion Bus
/MCS1	unassigned	M	XBUS
/PCS0	0000h-0007h	I/O	U7 UPD7210 GPIB Bus Interface
/PCS1	0080h-0081h	IO	U12 P82C79-5 Keyboard/Display CTRL
/PCS2	0100h	I/O	Front Panel Display (Command port)
	0101h		Front Panel Display (Data port)
	0102h	(WR)	U22 74ACT573 Output Latch bit 7 : /Status LED bit 6 : /GPIB Controller Enable bits 5-0 : Front Panel LEDs
/PCS3	0180h-0187h	I/O	U11 and U21 EEPROM CTRL (Control)
	0180h		SDA Serial Data Output Enable CTRL
	0181h		Write SDATA/ Read SDA
	0182h		SDC1 Data Clock CTRL (U11)
	0183h		SDC1 Data Clock CTRL, SDA Tristate
	0186h		SDC2 Data Clock CTRL (U21)
	0187h		SDC2 Data Clock CTRL, SDA tristate
	0180h	I/O (RD)	read /adc_busy signal (from U25)
/PCS4	0200h	I/O	U25 AD7569 Analog I/O System
/PCS5	0280h	I/O	XBUS
/PCS6	0300h	I/O	XBUS

The ASCII dot matrix display interface is comprised of:

- A Data Bus Transceiver and Control Signals
- +5 V for Backlighting (LCD type)
- Display Viewing Angle Adjustment circuitry(LCD type)

The data bus transceiver (U19 74ACT245) is used to transfer data between the MPU and the display module under the control of the DISP_E, DISP_RW, /DISP_DEN, and A0 signals (Refer to Table 5-3).

The display viewing angle may be adjusted using potentiometer R7, this provides an adjustable bias to the LCD crystal of +5 V to -5 V. The negative voltage is generated by a voltage inverter (U20 ICL7660) from the +5 V power supply.

The scanned matrix LED's are driven via the display section of a programmable keyboard/display interface IC (U12 82C79-5), in conjunction with U13 (74ACT541) buffer driver and U15/U16 open collector drivers. The controller is configured to drive four rows of up to eight columns. The column information is time multiplexed at the output of the 8279 OA0-OA3 and OB0-OB3, and driven by buffer driver U13 to increase the current drive to the LED's. The keyboard controller enables the respective row driver (/SL0-/SL3), which activates the open-collector drivers of U15/U16 to sink current, turning on the appropriate displays.

Six lines (D5-D0) of the output port latch (U22, 74ACT573) are used to drive dedicated LED's.

5-2.4.5 Keyboard Interface Section. The keyboard interface is controlled by a programmable keyboard /display controller (U12 82C79-5) operating under MPU control. The 8279 scans a matrix of switches looking for a key closure, providing for automatic switch debounce when

Table 5-3. Data Bus Control Signals

Signals				Description
DISP_E	DISP_RW	/DISP_DEN	A0	
0	X	X	X	Display Not Selected
1	1	0	1	Display Instruction Register
1	1	0	1	Write to Display Data Register
1	0	0	0	Read Display Busy Flag
1	0	0	1	Read Display Data Register

a switch is closed. A switch depression generates an interrupt to the MPU via an active high level on the IN signal. The keyboard controller derives its scanning clock from a division of the MPU generated TIMER1 signal. The TIMER1 signal is generated from the output of the 80C188 TIMER1 that has been programmed by the processor to produce a square wave with a freq of 1 MHz. The 8279 divides this clock signal to produce a scan cycle of approx 5 msec in duration. The 8279 is programmed to operate in an encoded scan mode whereby it sequentially activates one of the four scan lines /SL0-/SL3 while monitoring the eight return lines RL7-RL0 for a key closure to ground.

5-2.4.6 Analog I/O Section. The CPU PCB Assembly contains an eight bit DAC and ADC (U25 AD7569) that are available for general purpose use. The devices operate in a unipolar mode, with an input/output voltage range of 0 to +2.5V. The DAC is programmed by writing to I/O address /PCS4. The ADC conversion is controlled by generating a start conversion signal with the processor's timer 0 output signal. The status of the ADC's convert busy signal is made available to the processor via an I/O read operation that is controlled by the 22V10 PAL.

5-2.5 OUTPUT DRIVER SECTION. The output driver section consists of a Driver PCB Assembly that serves to interface the CPU PCB Assembly with the high-current driver pins, device power-supply selectors, configuration switches, and input status pins. Refer to Figure 9-6 as an aid in understanding the following discussions.

This Driver PCB Assembly interfaces with the CPU Assembly via the J3 Expansion Bus connector. The CPU PCB Assembly provides the Driver PCB Assembly with address, data bus, and control signal information. The lower-order address information (AD3-AD0) is demultiplexed and latched by U27 74HC75, to form A3-A0, and then presented to U1 16L8 PAL for selection of the various functions on the Driver PCB Assembly. PAL U1 serves to generate the output-enable, load, and clock signals required by the Driver PCB Assembly, as shown in Table 5-4.

The Driver PCB Assembly receives +5 V and +24 V from the Power Supply Assembly (A3). This Driver PCB Assembly contains circuitry to support a linear voltage regulator (an LM317 mounted on the chassis) that is used to derive a +12 Vdc supply from the +24 V input. The

Table 5-4. Data Bus Control Signals

Signals						Description
/PCS	A2	A1	A0	/RD	/WR	
1	X	X	X	X	X	Driver Card not selected
0	0	0	0	0	1	/ENA_RD0 active (U2 output enable)
0	0	0	1	0	1	/ENA_RD1 active (U29 output enable)
0	0	0	0	1	0	SCLK_A active (Port A shift register clock)
0	0	0	1	1	0	SCLK_B active (Port B shift register clock)
0	1	X	1	1	0	LOAD_A active (Load Port A shift register)
0	1	1	X	1	0	LOAD_B active (Load Port B shift register)

output voltage of the U30 programmable regulator is set by the ratio of resistors R20 and R21 according to the relationship Vout = Vref (1 + R21/R20), where V_{ref} = 1.25 V. This provides an output voltage from the regulator of approxiamatley +12.8 volts. A voltage selector switch (SW1/SW2) provides for the ability to set the operating voltage of the drivers (VSS_A/VSS_B) to one of either the +5 V, +12 V, or +24 V supplies. The V_{SS} outputs of each selector switch are monitored by an Under/Over voltage detector (ICL7665 U3/U4) to provide the setting of each selector switch to the processor. The ICL7665 contains two individually programmable voltage detectors, that are set up as simple threshold detectors to provide a window comparator. The ICL7665 consists of two comparators which compare input voltages on the SET1 and SET2 terminals to an internal 1.3 V band-gap reference. The outputs from the two comparators drive open-drain N-channel transistors for Out1 and Out2.

Input Voltage	Out1	Out2
V_{SET1} (VSS)	OFF (high)	ON (low)
$V_{SET1\&2}$	ON (low)	ON (low)
V_{SET2} (V_{SS})	On (low)	OFF (high)

The trip points for the detectors may be computed as follows:

Vtrip1 = 1.3 *(R2+R1)/R2 = 10.1 V
Vtrip2 = 1.3 *(R4+R3)/R4 = 20.4 V

Each driver port contains two 8-bit shift registers (74HC595) that contain the programming information for the true and complimentary drivers. The 74HC595 devices each contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Two 74HC595 devices are cascaded together to form a 16-bit shift register. Data from the least significant bit of the processor bus (AD0) is clocked into the shift register on the rising edge of the SRCK (SCLK_A/SCLK_B) signal when the processor performs an I/O write to the appropriate address (See table). Data from the shift registers is then transferred to the output storage register on the rising edge of the LOAD_A /LOAD_B signals under direction of the processor.

The output data from the shift registers is used as inputs to the SN754410 quad half-H drivers, whose outputs are available at either internal or external connectors for control of devices. The SN754410 is a quadruple high-current half-H driver, designed to drive inductive loads such as relays, as well as other high-current/high-voltage loads. Each output from the SN754410 is a complete totem-pole driver with a Darlington transistor sink and a pseudo- Darlington source, providing bidirectional drive currents.

Each external port also contains an input connection to an HCPL2730 opto coupler that may be used to provide a status signal input to the processor. The HCPL-2730 is a dual-input low current high-gain optocoupler. The input pins (/IN_A and /IN_B) to the optocoupler are connected as LOW active inputs, and will interface with any device capable of sinking approximately 5 mA of current in the active state.

U2 74ACT541 serves as an input port, allowing the processor to read the setting of the configuration DIP switch SW3 when /ENA_RD0 is at an active LOW level. U29 74ACT541 provides an input port that allows the processor to read the two voltage selector detectors (VA1, VA2, VB1, and VB2), the input status pins (/IN_A and /IN_B), and two shift register loopback signals (SRA_TEST and SRB_TEST).

Notes:

SECTION VI
MAINTENANCE

6-1 GENERAL.

This section contains procedures for operational checkout, inspection, preventive maintenance, special cleaning instructions, contacting Lucas Weinschel Inc, and removal and replacement of individual assemblies located in the Model 8200 Controller.

6-2 OPERATIONAL CHECKOUT.

Accomplish the operational checkout of the Model 8200 by performing all procedures located in Section VII. If a fault or problem should occur during these tests, perform the fault isolation procedures located in Section VII. This should ensure that the Model 8200 is operational.

6-3 INSPECTION.

Perform a visual inspection (Table 6-1) in conjunction with the maintenance activities schedule when a malfunction is suspected, or whenever an assembly is removed or replaced.

6-4 PREVENTIVE MAINTENANCE.

While the Model 8200 requires very little preventive maintenance, it should not be subjected to physical abuse, severe mechanical shock, high humidity, or operating temperatures outside the specification range. These instruments should be kept free of excessive dirt and dust, since these can interfere with connector functions and with normal heat dissipation. For cleaning instructions refer to paragraph 6-5 (special cleaning instructions). The following paragraphs provide the preventive maintenance that is to be performed on the Model 8200 Controller.

6-4.1 CONNECTORS. Care should be taken to prevent strain on the interconnecting cables, since damage here may not always be apparent. Occasionally check the external cables and connectors for signs of cracked insulation and/or bent or worn pins. Test show that connectors must be clean for accuracy and stability. This requires an inspection and cleaning of each connector immediately before use. For connector cleaning instructions, refer to paragraph 6-5.5. When cleaning precautions are observed regularly, connectors can maintain their stability for over several thousand connection cycles. Refer to Appendix A for more information about cables and connectors.

6-4.2 VERIFICATION TEST. The Performance and Verification Tests described in Section VII should be performed after any repair or replacement of an 8200 assembly. If a fault or problem occurs during these tests, perform the fault isolation procedures located in Section VII.

6-5 SPECIAL CLEANING INSTRUCTIONS.

The cleaning procedures for the Model 8200 are divided into six general groups: microwave coaxial cable assemblies, circuit card assemblies, machined surfaces and hardware, chassis cleaning, and connector cleaning. Table 1-3 provides a list of consumables recommended to perform these procedures.

6-5.1 MICROWAVE COAXIAL CABLE ASSEMBLIES. Appendix A (located at the end of this manual) provides all the necessary procedures for care, cleaning, and handling of microwave coaxial cable assemblies.

6-5.2 CIRCUIT CARD ASSEMBLIES. A protective coating (6, Table 1-3) is applied to circuit cards for protection from moisture, arcing, short-circuiting, and abrasion. To remove light dirt from circuit cards and modules, proceed as follows:

CAUTION

- DO NOT use a nylon bristle brush in the solvent as the bristles may dissolve and cause damage to the circuit card or component.
- DO NOT use ultrasonic cleaning on parts or assemblies containing electrical or electronic components.
- DO NOT bend pins of electrical connectors when using fiber-bristle brush (1, Table 1-3).

a. Briskly brush isopropyl alcohol (4) onto area to be cleaned with fiber-bristle brush (3).

b. Carefully remove residue with clean lint-free cloth (5) and repeat step 'a' as a rinse.

WARNING

Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/faceshields should be worn. DO NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum 15 psi to avoid personal injury.

Table 6-1. Model 8200 Inspection

ITEM	INSPECTION
Capacitors	Cracked, blistered, or dented; broken or loose seals or leads; signs of leakage (polarized tantalum capacitors); loose or missing mountings.
Castings, Housings	Dents, cracks, scratches, or other damage; loose or missing handles, brackets, or mounting hardware; damaged mounts; corrosion or excessive dirt.
Connectors	Bent , broken or corroded pins; Cracked or broken inserts; cracked or broken shell; loose or missing mounting nuts, washers, or screws; improper saddle clamp installation.
Diodes	Signs of overheating; cracked or broken case; broken seals or leads.
Hardware	Stripped threads, missing washers, corrosion, or other signs of damage.
Integrated Circuits	Signs of overheating; cracked or broken case; broken leads.
Interial Wiring	Frayed, broken, or abraded insulation; improperly dressed or tied cables; broken, corroded, or poorly soldered conductors at the terminals; missing or damaged sleeving at connector terminals.
Motors	Bent or broken shafts; loose or missing terminals or connecting wires; damaged or missing connecting hardware.
Painted Surfaces	Scratches, chips, or peeling.
Preformed Packing	Nicks, burrs, or foreign materials present.
Printed Circuit Boards	Broken or loose wires; damaged circuit traces (clad); damaged components or chassis; loose, missing, or damaged wires, cables, or hardware; poorly soldered connections; bent or broken connector pins.
Relays	Damaged castings, Loose or missing terminals or connectors.
Resistors	Cracked, broken, blistered, or charred body; broken or corroded leads; loose or missing mountings.
Switches	Signs of overheating; loose or broken terminals; lack of positive action.
Terminal Boards	Cracked, broken, blistered, or charred body; broken, loose, or corroded leads.

c. When parts are thoroughly clean, dry using 5 psi of clean moisture-free compressed air or preferably dry nitrogen (pressurized spray will work well).

6-5.3 MACHINED SURFACES AND HARDWARE. To remove light dirt and dust from mechanical parts such as castings, covers and other hardware, proceed as follows:

WARNING

Compressed air used for cleaning and/or drying can create airborne particles that may enter the eye. Goggles/faceshields should be worn. DO NOT direct air stream towards self or other personnel. Pressure should be restricted to a maximum 15 psi to avoid personal injury.

CAUTION

- Under no circumstances should a wire brush, steel wool, or abrasive compound be used on any suface. Using these items will cause extensive damage to the instruments surface.
- DO NOT use a nylon-bristle brush in solvent as the bristles may dissolve and cause damage to the circuit card or component

a. Use 5 psi of clean, moisture-free compressed air or preferably dry nitrogen to blow loose dirt and dust from surface of item

b. Briskly brush isopropyl alcohol (4, Table 1-3) onto area to be cleaned with a fiber-bristle brush (1).

c. Remove residue with lint-free cloth (5) and repeat step "b" as a rinse.

d. When parts are thoroughly clean, dry using 5 psi of clean, moisture-free compressed air or preferably dry nitrogen.

e. Clean smaller mechanical parts or hardware by dipping into a container of isoporpyl alcohol (4). Remove dirt by brushing with fiber-bristle brush (1) after parts have been immersed for several hours.

f. Remove parts from isopropyl alcohol (4) and rinse by immersing in a different container of isopropyl alcohol (4).

g. When parts are thoroughly cleaned, dry using 5 psi of clean, moisture-free compressed air or preferably dry nitrogen.

6-5.4 CHASSIS CLEANING. Clean chassis using a lint-free cloth (5, Table 1-3) moistened with water and mild detergent. For harder to clean areas, such as inside corners of chassis, use a vacuum cleaner.

6-5.5 CONNECTOR CLEANING. Where small amounts of rust, corrosion, and/or oxide deposits are present on connectors, clean externally with a fiber-bristle brush (3, Table 1-3), aluminum wool (2), or internally with an acid brush; then wash with a noncorrosive solvent. MIL-C-83102 is recommended. Exercise care to ensure no metal filing or residue remains inside the connector and the connector is thoroughly dry. Where rust, corrosion, and/or oxide deposits are present in large quantities, replace the connector.

6-6 CONTACTING LUCAS WEINSCHEL INC.

DO NOT return any instrument or component to the factory without prior authorization. When an instrument or component has to be returned to the factory, Section I provides the necessary information to contact and return the instrument or component to Lucas Weinschel Inc.

6-7 REPAIR AND REPLACEMENT.

WARNING

- Ensure the facility power is removed before removing or installing any component.
- Soldering and/or unsoldering can cause burns to personnel. Provide adequate ventilation. Avoid breathing the fumes of solder and flux. Personnel should wear approved safety equipment.

CAUTION

- DO NOT use excessive heat when soldering. The use of a low wattage pencil-type soldering equipment is recommended.
- When removing an assembly from the instrument, DO NOT overextend wires/cables beyond their physical limits.

NOTE

- Before installing any component or assembly into the instrument, inspect it in accordance with Table 6-1.
- To facilitate installation, bag and mark all mounting hardware and tag all wires/cables during removal with sufficient information to allow reconnection. Then remove tag after installation. This is recommended to ensure proper installation of the component or assembly.
- For consumables, refer to Table 1-3.
- Refer to Replaceable Parts List, Section VIII, for replacement part number information.
- These procedures are provided as a guide line only. Read the complete procedure before performing task. Perform the steps in the exact order.

Table 6-2 provides removal procedures for the major assemblies located in the Controller. The major assemblies are grouped together by reference designator and listed in ascending numerical order. Assemblies which the removal and installation procedures are considered obvious do not appear in Table 6-2 .

Table 6-2. Model 8200 Removal and Installation

REF DES	NOMENCLATURE	PROCEDURE
A1	**Central Processor Unit PCB Assembly (CPU)**	**WARNING** Ensure that all POWER is removed from the instrument before removing any component or assembly. **NOTE** Use Figure 9-1 as an aid in removing or installing components located in the Model 8200 Controller. **Removal:** a. Remove two screws attaching top cover and slide cover towards the rear of the Model 8200, until cover is removed. b. Disconnect cables from CPU Assembly. c. Remove four screws attaching CPU Assembly to the Model 8200. d. To disconnect the CPU Assembly from the Driver PCB Assembly (A2), carefully slide CPU Assembly towards front of the Model 8200. Remove CPU Assembly from Model 8200. **Installation:** a. Using Figure 9-1, align CPU Assembly connector (J6) with Driver PCB Assembly connector (J3). Carefully slide the two PCB Assemblies together. b. Secure CPU Assembly using four screws previously removed. c. Connect cables to the CPU Assembly as follows: A3W1 to J5 A3W2 to J4 W1 to J3 d. Carefully slide top cover into Model 8200 and secure using screws previously removed.

Table 6-2. Model 8200 Removal and Installation (Con't)

REF DES	NOMENCLATURE	PROCEDURE
A2	Driver PCB Assembly	**WARNING** Ensure that all POWER is removed from the instrument before removing any component or assembly. **NOTE** Use Figure 9-1 as an aid in removing or installing components located in the Model 8200 Controller. **Removal:** a. Remove two screws attaching top cover and slide cover towards the rear of the Model 8200, until cover is removed. b. Disconnect cables/wiring from Driver PCB Assembly connectors J5 and/or J6. c. Remove four screws attaching Driver PCB Assembly to the Model 8200. d. Disconnect the IEEE-488 bus cable (W1) from J3 located on the CPU Assembly. e. Remove four screws attaching CPU Assembly to the Model 8200. f. To disconnect the CPU Assembly from the Driver PCB Assembly (A2), carefully slide CPU Assembly towards front of the Model 8200. g. Disconnect cable W1 from CPU Assembly and slide the CPU Assembly forward enough to remove Driver PCB Assembly from the Model 8200. h. Remove four screw locks attaching Driver PCB Assembly's Device Port A and B connector to the rear panel. Remove Driver PCB Assembly from Model 8200.

Table 6-2. Model 8200 Removal and Installation (Con't)

REF DES	NOMENCLATURE	PROCEDURE
A2	**Driver PCB Assembly (CON'T)**	**Installation:** a. Using Figure 9-1, align CPU Assembly connector (J6) with Driver PCB Assembly connector (J3). Carefully slide the two PCB Assemblies together. b. Carefully position the two connected PCB Assemblies onto the standoffs and secure using the eight screws previously removed (four per assembly). c. Using the four screw-lock fasteners previously removed, secure the Driver PCB Assembly to the Model 8200 rear panel. d. Connect cable W1 to the CPU Assembly connector (J3). e. If necessary, connect the cables/wiring previously removed from Device Port A and B connectors (J5 and J6). f. Carefully slide top cover into Model 8200 and secure using screws previously removed.
A3	**Switch/LED Status PCB Assembly**	**WARNING** Ensure that all POWER is removed from the instrument before removing any component or assembly. **NOTE** Use Figure 9-1 as an aid in removing or installing components located in the Model 8200, Controller. **Removal:** a. Remove two screws attaching top cover and slide cover towards the rear of the Model 8200, until cover is removed.

Table 6-2. Model 8200 Removal and Installation (Con't)

REF DES	NOMENCLATURE	PROCEDURE
A3	**Switch/LED Status PCB Assembly(CON'T)**	b. Remove two screws attaching bottom cover and slide cover towards the rear of the Model 8200, until cover is removed. c. Disconnect cables A3W1 and A3W2 from CPU Assembly connectors J4 and J5. d. Disconnect cables from the front Panel RF IN and RF OUT connectors (if installed in your Model 8200). e. Remove two Trim Strips covering the front panel mounting screws. f. Remove eight screws attaching the front panel to the Model 8200. g. Carefully slide the front panel away from the Model 8200 . DO NOT overextend the POWER switch wiring. h. Remove four screws attaching the Switch/ LED Status PCB Assembly to the Front Panel. Remove Switch/LED Status PCB Assembly from the Model 8200. **Installation:** a. Using Figure 9-1, position the Switch/LED Status PCB Assembly onto the standoffs located on the Front Panel and secure using the four screws previously removed. b. Position Front Panel into Model 8200 and secure using eight screws previously removed. c. Install trim strips. d. Connect cable A3W1 to CPU Assembly connector J5 and cable A3W2 to CPU Assembly connector J4. e. Connect RF cables to the RF IN and RF OUT connectors located on the Front Panel. Torque all SMA connectors 7 to 10 inch pounds. f. Carefully slide top cover into Model 8200 and secure using screws previously removed. g. Carefully slide bottom cover into Model 8200 and secure using screws previously removed.

Table 6-2. Model 8200 Removal and Installation

REF DES	NOMENCLATURE	PROCEDURE
A4	**Power Supply Assembly**	**WARNING** Ensure that all POWER is removed from the instrument before removing any component or assembly. **NOTE** ● Use Figure 9-1 as an aid in removing or installing components located in the Model 8200 Controller. ● This assembly is an inexpensive throw-away type module. LWI recommends replacement instead of repairing the Power Supply Assembly. **Removal:** a. Remove two screws attaching bottom cover and slide cover towards the rear of the Model 8200, until cover is removed. b. Disconnect cables to the Power Supply Assembly (A4). c. Remove four screws attaching the Power Supply Assembly to the Model 8200. Remove Power Supply Assembly. **Installation:** a. Using Figure 9-1, position the Power Supply Assembly into the Model 8200 and secure using screws previously removed. b. Connect cables to the Power Supply Assembly as shown in Figure 9-2. c. Carefully slide bottom cover into Model 8200 and secure using screws previously removed.

Notes:

SECTION VII
PERFORMANCE TESTING AND TROUBLESHOOTING

7-1 GENERAL.

This sections contains the performance testing and troubleshooting procedures to ensure that the Model 8200 is operational and performing within its design specifications. The following paragraphs provide testing procedures that can serve as an incoming inspection when the instrument is first received, and can be performed every six months thereafter as a regular maintenance procedure. The testing procedures should also be performed after any repair or replacement of a PCB assembly or component located in the instrument. Troubleshooting is also provided to isolate a problem to a faulty PCB Assembly and/or Attenuator.

7-2 TESTING.

The following paragraphs provide the necessary test procedures to accurately test your Model 8200. All tests should be run in sequence to ensure proper operation of the instrument. All test setups should include equipment that has a valid, up-to-date calibration sticker, or is otherwise certified to be in calibration. The instruments should have all covers installed and has no missing hardware. NO adjustments or other maintenance procedures should be performed after testing has begun, unless the test procedure points out a specific adjustment procedure. If a failure occurs, STOP testing at once, correct the malfunction and then resume testing (It is recommended that all tests be repeated from the beginning).

7-2.1 POWER-UP VERIFICATION. The following precedure steps will determine if the Model 8200 is operational and ready for use.

a. Place the POWER ON-OFF to ON and verify the following:

- The ADRS LED is illuminated and the current or factory set address (710) is displayed in Device Port A.
- The PRGM LED is also illuminated and the current solftware verision is displayed in Device Port B.
- After about five seconds the Model 8200 will display the current configuration of each port (each Model 8200 has been factory set to illuminate the +5 V and SINK indicators on each port, unless a device has been factory installed into the Model 8200).

b. Press one of the eight data switches located in Device Port A switch bank. Verify that the Port A PGRM LED is flashing and the Data Switch LED is illuminated. Pressing the SET Key once more will cause the PRGM LED to stop flashing and the Data Switch LED to stay illuminated. The Voltage level of this data switch can be measured at the appropriate output pin of the Rear Panel Connector of Device Port A.

c. Pressing the same Device Port A data switch causes the Port A PGRM LED to start flashing and the Data Switch LED is not illumated. Pressing the SET Key once more will cause the PRGM LED to stop flashing and the Data Switch LED to be OFF. Repeat steps b and c for all Data Switches in Device Port A.

d. Press one of the eight data switches located in Device Port B switch bank. Verify that the Port B PGRM LED is flashing and the Data Switch LED is illumated. Pressing the SET Key once more will cause the PRGM LED to stop flashing and the Data Switch LED to stay illuminated. The Voltage level of this data switch can be measured at the appropriate output pin of the Rear Panel Connector of Device Port B.

e. Pressing the same Device Port B data switch causes the Port B PGRM LED to start flashing and the Data Switch LED is not illuminated. Pressing the SET Key once more will cause the PRGM LED to stop flashing and the Data Switch LED to be OFF. Repeat steps d and e for all Data Switches in Device Port B.

f. Place POWER ON-OFF switch to OFF. Remove two screws attaching the top cover to the Model 8200. Carefully slide the top cover towards the rear of the instrument until removed.

CAUTION

Ensure POWER has been removed from the Model 8200 before attempting to change the Voltage/Selector Switch(s).

g. Change the Device Port A and B Voltage/Selector Switches to +24 V.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. DO NOT place hands or metal objects near live circuits.

h. Place the POWER ON-OFF to ON and verify the following:

- The ADRS LED is illuminated and the current or factory set address (710) is displayed in Device Port A.
- The PRGM LED is also illuminated and the current solftware version is displayed in Device Port B.
- After about five seconds the Model 8200 will illuminate the +24 V LED and indicate the selected SINK or SCE mode of operation.

i. Place POWER ON-OFF switch to OFF.

CAUTION

Ensure POWER has been removed from the Model 8200 before attempting to change the Voltage/Selector Switch(s).

j. Change the Device Port A and B Voltage/Selector Switches to +12 V.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. DO NOT place hands or metal objects near live circuits.

k. Place the POWER ON-OFF to ON and verify the following:

- The ADRS LED is illuminated and the current or factory set address (710) is displayed in Device Port A.
- Also the PRGM LED is illuminated and the current solftware verision is displayed in Device Port B.
- After about five seconds the Model 8200 will illuminate the +12 V LED and indicate the selected SINK or SCE mode of operation.

l. Place POWER ON-OFF switch to OFF.

CAUTION

Ensure POWER has been removed from the Model 8200 before attempting to change the Drive Type Selection Switch(s).

m. Using the Device Port A and B Drive Type Selection Switches, change the Driver type to SCE for both ports.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. DO NOT place hands or metal objects near live circuits.

n. Place the POWER ON-OFF to ON and verify the following:

- The ADRS LED is illuminated and the current or factory set address (710) is displayed in Device Port A.
- Also the PRGM LED is illuminated and the current solftware verision is displayed in Device Port B.
- After about five seconds the Model 8200 will illuminate the +12 V LED and illuminate the SCE LED.

o. Place POWER ON-OFF switch to OFF. Carefully slide the top cover into the Model 8200 and secure, using the two screws previously removed.

7-2.2 POWER SUPPLY CHECKS. Table 7-1 lists several points at which measurements can be taken to determine a faulty power supply. The +5 V supply can be adjusted to +5 ± 0.25 V.

Table 7-1. Power Supply Test Points.

Test Point	Measured Value
A2TP2 or A2E8 or A2E11 *	+5 ± 0.25 V
A2E7 or A2J4 pin 2*	+24 ± 4.6 V
A2J4 pin 3*	+12 ± 1.2 V

* Note: A2TP1 can be used as GND for all measurements.

7-3 TROUBLESHOOTING.

Table 7-2 is provided as an aid in locating defective assemblies, modules, and/or components in the Controller. Begin at start and perform all steps described. When a defective assembly and/or component is located, replace it using Section V of this manual. After the component is replaced, perform all tests located in paragraph 7-2 to ensure proper operation of the instrument.

WARNING

Sufficient power levels are present at the Power Input Assembly to cause personal injury. Use extreme caution when making any measurements with power applied.

Table 7-2. Model 8200 Troubleshooting

Trouble	Probable Cause	Remedy
1. Front panel LED's do not illuminate correctly when power is applied.	Defective input power fuse or Power Supply Assembly (A3)	Using ohm meter check fuse (F1); if defective replace, F1. If fuse is OK or problem still exsists perform the following: a. Verify that the Power Entry Module Assembly is set to match the Input power source. b. After determining the Power Entry Module Assembly has the correct setting, remove top cover and place the POWER ON-OFF switch to ON. Using a voltmeter, measure voltage between XF1 pin N and XF1 pin L. Verify one of the following: (1) Voltage is 110± 20 Vac, if the Power Entry Module Assembly is set to 110 Vac. or (2) Voltage is 220 ± 40 Vac, if the Power Module Assembly is set to 220 Vac. c. If measurement in step b is incorrect, replace XF1. If measurement is correct, measure between S1 pin 3 and S1pin 6. Verify one of the following:

Table 7-2. Model 8200 Troubleshooting (Con't)

Trouble	Probable Cause	Remedy
1. (Con't)		(1) Voltage is 110 ± 20 Vac, if the Power Entry Module Assembly is set to 110 Vac. or (2) Voltage is 220 ± 40 Vac, if the Power Entry Module Assembly is set to 220 Vac. d. If measurement in step c is incorrect, replace S1 and/or repair asscoiated wiring. If measurement is correct, measure the following: (1) If the Power Entry Module Assembly is set to 110 Vac. Measure between A3 pin 5 and A3 pin 3. Verify the voltage is 110 ± 20 Vac. or (2) If the Power Entry Module Assembly is set to 220 Vac. Measure between A3 pin 1 and A3 pin 3. Verify the voltage is 220 ± 40 Vac. e. If measurement in step d is incorrect, replace XF1 and/or repair asscoiated wiri If measurement is correct, measure and verify the voltages at following test points: A2E7 +24 ± 4.6 V A2E8 +5 ± 0.25 V A2E11 +5 ± 0.25 V A2E9 AGND (0 V) A2E10 GND (0 V) f. If any of the voltages in step e are incorrect, replace Power Supply Assembly (A3) and/or repair asscoiated wiring. If all voltages are correct, measure voltage between A1J6 pin 40 and A1J6 pin 38. Verify voltage is +5 ± 0.25 V. g. If voltage measurement in step f is incorrect, repair/replace Driver PCB Assembly. If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).
2. Device Port A or B Switch LEDs are incorrect.	Defective Switch LED.	Replace defective LED. If LED is still not illuminated after replacement, perform th following:

Table 7-2. Model 8200 Troubleshooting (Con't)

Trouble	Probable Cause	Remedy
2. (Con't)		a. Measure and verify the voltages at following test points: A2E7 +24 ± 4.6 V A2E8 +5 ± 0.25 V A2E11 +5 ± 0.25 V A2E9 AGND (0 V) A2E10 GND (0 V) b. If any of the voltages in step a are incorrect, replace Power Supply Assembly (A3) and/or repair assoiated wiring. If all voltages are correct, measure voltage between A1J6 pin 40 and A1J6 pin 38. Verify voltage is +5 ± 0.25 V. c. If voltage measurement in step b is incorrect, repair/replace Driver PCB Assembly. If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).
3. + 24 V LED does not illuminate in Device Port A and/or B.	Voltage/Selector Switch is in incorrect position.	Check Voltage/Selector Switch for port that contains the defective LED. Verify that the switch is in the +24 V position. If correct measure for +24 ± 4.6 V at rear panel connector J5 pin 16 or 3 (for Device Port A) or J6 pin 16 or 3 (for Device Port B). a. If voltage is correct, repair/replace Front Panel LED/Switch PCB Assembly (A4). If voltage is incorrect, measure for +24 ± 4.6 V at A2E7. b. If voltage at A2E7 is incorrect, replace Power Supply Assembly (A3). If voltage at A2E7 is correct, measure voltage between A1J6 pin 40 and A1J6 pin 38. Verify voltage is +5 ± 0.25 V. c. If voltage measurement in step b is incorrect, repair/replace Driver PCB Assembly. If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).

Table 7-2. Model 8200 Troubleshooting (Con't)

Trouble	Probable Cause	Remedy
4. + 5 V LED does not illuminate in Device Port A and/or B.	Voltage/Selector Switch is in incorrect position.	Check Voltage/Selector Switch for port that contains the defective LED. Verify that the switch is in the +5 V position. If correct measure for +5 ± 0.3 V at rear panel connector J5 pin 14 or 1 (for Device Port A) or J6 pin 14 or 1 (for Device Port B) a. If voltage is correct, repair/replace Front Panel LED/Switch PCB Assembly (A4). If voltage is incorrect, measure for +5 ± 0.3 V at A2E8 and/or A2E11. b. If voltage at A2E8 or A2A11 are incorrect, replace Power Supply Assembly (A3). If voltage at A2E8 and A2E11are correct, measure voltage between A1J6 pin 40 and A1J6 pin 38. Verify voltage is +5 ± 0.3 V. c. If voltage measurement in step b is incorrect, repair/replace Driver PCB Assembly (A2). If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).
5. + 12 V LED does not illuminate in Device Port A and/or B.	Voltage/Selector Switch is in incorrect position.	Check Voltage/Selector Switch for port that contains the defective LED. Verify that the switch is in the +12 V position. If correct measure for +12 ± 1.2 V at rear panel connector J5 pin 15 or 2 (for Device Port A) or J6 pin 15 or 2 (for Device Port B). a. If voltage is correct, repair/replace Front Panel LED/Switch PCB Assembly (A4). If voltage is incorrect, measure for +24 ± 4.6 V at A2E7. b. If voltage at A2E7 is incorrect, replace Power Supply Assembly (A3). If voltage at A2E7 is correct, measure voltage at U1 pin 2 and verify voltage is +24 ± 4.6 V. c. If voltage is incorrect at U1 pin 2 repair/ replace Driver PCB Assembly (A2) and/or assoiated wiring. If correct, measure for +12 ± 1.2 V at U1 pin 3. d. If voltage is incorrect at U1 pin 3, replace U1. If correct, measure voltage between A1J6 pin 40 and A1J6 pin 38. Verify voltage is +5 ± 0.25 V.

Table 7-2. Model 8200 Troubleshooting (Con't)

Trouble	Probable Cause	Remedy
5. (Con't)		e. If voltage measurement in step b is incorrect, repair/replace Driver PCB Assembly. If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).
6. IEEE-488 Bus does not function.	Incorrect bus address.	Ensure the Model 8200 and bus controller addresses are the same. (Use known good controller). If addresses are the same, repair /replace CPU (A1) and/or internal Bus cable (W1).
7. Output drivers do not operate properly.	Device is incorrectly installed.	Check device setup (Section IV provides many types of device setups). If after checking the setup, the problem still exsists, place the controller into the manual mode and perform the following: a. Using the front panel Device Port A and B switches, select the suspected faulty driver by pressing the Front Panel Data Switch. Verify that the PGRM LED is flashing and the Data Switch LED is illuminated. Pressing the SET Key once more will cause the PRGM LED to stop flashing and the Data Switch LED to stay illuminated. The Voltage level of this data switch can be measured at the appropriate output pin of Rear Panel Connector. b. If voltage is correct, repair/replace Front Panel LED/Switch PCB Assembly (A4). If voltage is incorrect, measure for +24 ± 4.6 V at A2E7. c. If voltage at A2E7 is incorrect, replace Power Supply Assembly (A3). If voltage at A2E7 is correct, measure voltage at U1 pin 2 and verify voltage is +24 ± 4.6 V. d. If voltage is incorrect at U1 pin 2 repair/ replace Driver PCB Assembly (A2) and/or assoiated wiring. If correct, measure for +12 ± 1.2 V at U1 pin 3.

Table 7-2. Model 8200 Troubleshooting

Trouble	Probable Cause	Remedy
7. (Con't)		e. If voltage is incorrect at U1 pin 3 , replace U1. If correct, measure voltage between A1J6 pin 40 and A1J6 pin 38 Verify voltage is +5 ± 0.25 V. f. If voltage measurement in step b is incorrect, repair/replace Driver PCB Assembly. If voltage measurement is correct, repair/replace CPU (A1), and/or Front Panel LED/Switch PCB Assembly (A4).

SECTION VIII
REPLACEABLE PARTS LIST

8-1 GENERAL.

This Replaceable Parts List (RPL) lists and describes the parts located in the Model 8200 Controller P/N 193-1000. This RPL is intended for use in identifying, locating, and requisitioning assemblies and components for the instrument.

8-2 UNDERSTANDING REFERENCE DESIGNATORS.

All assemblies and electrical parts are identified by standard reference designators (resistors R1, for example). Reference designators are used in parts lists and on parts identification drawings. The title of a parts list or drawing contains the reference designator or the assembly or subassembly to which it applies. Use the designators in the title of the parts list, as a prefix, but omitted from the list to make it easier to locate a specific part. To complete a reference designator in a parts list, precede the designator for the specific part (DS1, for example) with the designator in the title (A6, for example) to form a complete reference designator for the part (in this case, A6DS1).

8-3 ORDERING INFORMATION.

When ordering parts from Lucas Weinschel Inc, please include the following information:

- Lucas Weinschel Inc part number.
- Description of the component or part.
- Model and serial number of the instrument.
- Assembly number and assembly revision (if any) from the assembly (this information is on the component side of the PCB).

8-4 DRAWING NUMBER.

The Lucas Weinschel Inc part number consists of basic number with a dash number. The basic number should cross-reference to a drawing number for most of the items. For those items that do not have a drawing number, the manufacturer's part number is provided.

8-5 REPLACEABLE PARTS LIST (RPL).

8-5.1 GENERAL. This RPL contains a breakdown of the instrument into its major assemblies, sub-assemblies, and detailed parts. The following paragraphs describe the contents of each column of the RPL.

8-5.2 REFERENCE DESIGNATOR. This column contains reference designators arranged in alphanumerical sequence. The letters A thru Z have precedence, followed by numerals 0 thru 9. In addition to the reference designators that are listed, some mechanical parts are also listed. These items lack reference designators and are included because they are considered subject to wear and/or breakage, or because they are custom (non-standard) hardware or parts that might become lost or damaged. This column contains N/A for those items or parts not having a reference designator.

8-5.3 DESCRIPTION. This column contains the nomenclature located in the title block of the engineering drawing by the designing activity. The noun name is listed first, followed by modifiers and descriptive information to completely identify the part or assembly.

8-5.4 LUCAS WEINSCHEL INC PART NUMBER. This column contains the Lucas Weinschel Inc part number assigned to an assembly, subassembly, or detailed part. This column also includes LWI numbers for specification control, source control, and altered item drawings.

8-5.5 MFG PART NUMBER. This column contains manufacturer's part numbers for those parts Lucas Weinschel Inc purchases as-off-the shelf items and assigns LWI part numbers for internal control only. These parts may be ordered through the manufacturer or through Lucas Weinschel Inc by the LWI part number.

8-5.6 CAGE CODE. This column provides the Commercial and Government Entity (CAGE) code on the same line as the applicable part number. Codes, names, and addresses of vendors with an assigned CAGE are listed in Cataloging Handbook H4-1 and H4-2. Vendors that have not been assigned CAGE codes by the government are identified by the word NONE in this column. The names and addresses of these vendors can be obtained from Lucas Weinschel Inc.

CAUTION

This instrument contains items identified as ⏀. When handling or shipping these items, the ESD Handling must be performed in accordance with ESD device handling procedures in IM-210 or other accepted ESD procedures. Failure to comply **WILL RESULT** in ESD damage.

8-6 ASSEMBLY AND COMPONENT LOCATION.

The Assembly and component location diagrams for the Frequency Extension are located in Section IX.

8-7 REMOVAL AND REPLACEMENT.

Procedures for removal and installation of assemblies and components located in the Model 8200 are located in Section V.

Table 8-1. Controller, Model 8200

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	SCR PAN HD SELFLOCK 4-40 X 3/8	NAS1635-04LR6			
NA	SCR PAN HD SELF LOCK 4-40X5/16	NAS1635-04LR5			
NA	SCR FLAT HD 4-40 X 1/4 LG 100	MS24693-C2			
NA	O & S MANUAL 8200 CONTROLLER	IM214			
A1	ASSY PCB CPU	193-1500-000			
NA	ASSY CABINET	193-1400			
A4	ASSY PCB FRONT PANEL LED/SWITCH	193-1300-000			
A2	ASSY PCB DRIVER BOARD	193-1200-000			
W1	ASSY CABLE IEEE BUS	193-1005			
NA	TRIM STRIP	193-1004			
NA	SIDE PANEL	193-1003			
NA	ASSY COVER BOTTOM	193-1002			
NA	COVER, TOP	193-1001-2			
NA	LABEL WARNING HIGH VOLTAGE	090-354			
NA	NAMEPLATE	090-301			
NA	ICD 8200 CONTROLLER	089-2404			
NA	HOLE PLUG 3/8 HOLE NYLON BLACK	074-761-1	3091	83330	
NA	SCREW MOUNTING KIT METRIC	074-684	552633-3	779	
NA	CORD POWER SUPPLY MOLDED VINYL GRD PLUG 1250W 10A-125V	068-21	17250	16428	
NA	CONN SCREW LOCK FEMALE	062-184-5	D20418-2	71468	
NA	FUSE 1/4 AMP SLO BLO	052-1-1/4SB	313.250	75915	
NA	FUSE 1/2 AMP SLO BLO	052-1-1/2SB	313.500	75915	

Table 8-2. ASSY, Driver PCB (P/N 193-1200-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	NUT HEX #4 CRES SMALL PATTERN	NAS671C4			
NA	WASHER FLAT #4 SS	NAS620C4			
NA	WASHER LOCK #4	NAS1676C4			
NA	SCR PAN HD 4-40 X 3/8 LG	MS51957-15			
NA	SCR PAN HD 4-40 X 5/16 LG	MS51957-14			
NA	WASHER FLAT #4	MS51859-2			
NA	NUT HEX #4	MS51858-2			
NA	LOCTITE 242, (BLUE) REMOVABLE THREADLOCK MEDIUM STRENGTH	COML-55			
U1	IC PAL	193-1201			
NA	SCHEMATIC DIAGRAM	193-1200-200			
NA	FAB PCB DRIVER BD	193-1200-100			
NA	WIRE #22 RED TEFLON	079-147-2			
NA	WIRE #22 WHT/ORN TEFLON	079-147-17			
NA	WIRE #22 BLACK TEFLON	079-147-10			
TP1	TEST POINT	074-820	TP-101-10	26364	
TP2	TEST POINT	074-820	TP-101-10	26364	
NA	CABLE TIE	074-170-5	TY-33M	56501	
J1	CONN SUBMIN D RT ANGLE 25 CONTACT FLG MT HOLES W/THD INSR	062-340	EDBL25SBA1	71468	
J2	CONN SUBMIN D RT ANGLE 25 CONTACT FLG MT HOLES W/THD INSR	062-340	EDBL25SBA1	71468	
J4	CONN HEADER 3 PIN .156 CENTERS	062-327-3	26-48-1036	27264	
NA	CONTACT CRIMP 18-24 AWG TIN PLATING LOOSE	062-327-1	08-50-0106	27264	
NA	CONN HOUSING PCB MOD W/LOCKING RAMP 6 CIRCUITS	062-276	09-50-3061	27264	
J5	CONN HEADER 26 PINS	062-204-26	1-103169-1	779	
J6	CONN HEADER 26 PINS	062-204-26	1-103169-1	779	
J3	CONN DBL ROW RECEPT ASSY .100 CTRS 40 PIN	062-199-40	1-85930-4	779	
XU1	SOCKET 20 PIN CONTACT DIP	061-85-20	520-AG19D	91506	
S3	SWITCH PACKAGE 8 POS 7000 SERIES SPST DUAL IN LINE	055-59	435166-5	779	
S1	SWITCH PC MT SLIDE DP3T	055-104	L203-12-1-MS-19353		

Table 8-2. ASSY, Driver PCB (P/N 193-1200-000) CON'T

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
S2	SWITCH PC MT SLIDE DP3T	055-104	L203-12-1-MS-19353		
C26	CAP CER .33UF 10% 50V	034-28-334	CK06BX334K	56289	
C4	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C5	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C6	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C7	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C8	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C9	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C10	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C11	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C16	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C17	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C18	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C19	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C20	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C21	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C22	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C23	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C15	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C12	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C13	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C24	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C25	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C28	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C14	CAP CER .01UF 100V 10%	034-27-103	CK05BX103K	56289	
C1	CAP TANT 47UF 10% 35V	031-112-476	T368D476K035AS5397		
C2	CAP TANT 47UF 10% 35V	031-112-476	T368D476K035AS5397		
C3	CAP TANT 47UF 10% 35V	031-112-476	T368D476K035AS5397		
C27	CAP TANT 10UF 10% 35V	031-112-106	T368C106K035AS5397		
U17	RES NETWORK COMMON 10 PIN SIP 10K 2%	028-09-103	4310R-101-103	80294	
R19	RES WW 220 5% 3W	026-79-220	23J220	44655	
R17	RES METALFILM 75K 1% 1/4W	025-33-7502	CCF55-7502F	91637	
R3	RES METALFILM 68.1K 1% 1/4W	025-33-6812	CCF55-6812F	91637	
R7	RES METALFILM 68.1K 1% 1/4W	025-33-6812	CCF55-6812F	91637	

Table 8-2. ASSY, Driver PCB (P/N 193-1200-000) CON'T

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
R2	RES METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637	
R4	RES METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637	
R6	RES METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637	
R8	RES METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637	
R22	RES METALFILM 34.8K 1% 1/4W	025-33-3482	CCF55-3482F	91637	
R1	RES METALFILM 31.6K 1% 1/4W	025-33-3162	CCF55-3162F	91637	
R5	RES METALFILM 31.6K 1% 1/4W	025-33-3162	CCF55-3162F	91637	
R15	RES METALFILM 2.61K 1% 1/4W	025-33-2611	CCF55-2611F	91637	
R16	RES METALFILM 2.61K 1% 1/4W	025-33-2611	CCF55-2611F	91637	
R20	RES METALFILM 237 1% 1/4W	025-33-2370	CCF55-2370F	91637	
R21	RES METALFILM 2.15K 1% 1/4W	025-33-2151	CCF55-2151F	91637	
R9	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R10	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R11	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R12	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R13	RES METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637	
R14	RES METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637	
R18	RES METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637	
U19	IC VOLTAGE REFERENCE	015-8211	ICL8211CPA	32293	
U3	IC U/O VOLTAGE DETECTOR	015-7665	ICL7665SCPA	32293	
U4	IC U/O VOLTAGE DETECTOR	015-7665	ICL7665SCPA	32293	
U6	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U7	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U9	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U10	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U12	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	

Table 8-2. ASSY, Driver PCB (P/N 193-1200-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
U13	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U15	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U16	IC QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295	
U18	IC LATCH 4 BIT BISTABLE	015-74HC75	MC74HC75N	4713	
U5	IC 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	1295	
U8	IC 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	1295	
U11	IC 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	1295	
U14	IC 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	1295	
U2	IC OCTAL BUS DRIVER	015-74ACT541	V74ACT541P	9Z527	
U29	IC OCTAL BUS DRIVER	015-74ACT541	V74ACT541P	9Z527	
U25	IC OPTO COUPLER DUAL LOW INPUT CURRENT HI GAIN	015-2730	HCPL2730	28480	
CR1	DIODE RECTIFIER 100V	012-293	1N4002	4713	

Table 8-3. ASSY, Front Panel LED/Switch PCB (P/N 193-1300-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	ASSY CABLE FRONT PANEL TO CPU	193-1302			
NA	ASSY CABLE FRONT PANEL TO CPU	193-1301			
NA	SCHEMATIC DIAGRAM FRONT PANEL LED/SWITCH	193-1300-200			
NA	FAB PCB FRONT PANEL DISPLAY	193-1300-100			
NA	LABEL	090-371-2			
NA	LABEL	090-371-1			
XDS17	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS18	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS19	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS20	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS21	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS22	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS24	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS25	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS27	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS28	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS29	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS30	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS31	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS32	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS33	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
XDS34	SOCKET 4 PIN .1 SPACING	061-111	SSK-104-S-T	55322	
S1	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S2	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S3	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	

Table 8-3. ASSY, Front Panel LED/Switch PCB (P/N 193-1300-000) CON'T

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
S4	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S5	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S6	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S7	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S8	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S9	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S10	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S11	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S12	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S13	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S14	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S15	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S16	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S17	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
S18	SWITCH PUSHBUTTON PCB MTG ILLUMINATED YELLOW	055-103-3	81-20101-04	SECMA	
NA	LENS CLEAR	055-103-12	83-00000-00	SECMA	
NA	SWITCH PUSHBUTTON DK GREY	055-103-11	80-11011-07	SECMA	
DS17	LED LIGHT BAR RED	012-456	OLB-2300	25088	

Table 8-3. ASSY, Front Panel LED/Switch PCB (P/N 193-1300-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
DS18	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS19	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS20	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS21	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS22	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS24	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS25	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS27	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS28	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS29	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS30	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS31	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS32	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS33	LED LIGHT BAR RED	012-456	OLB-2300	25088	
DS34	LED LIGHT BAR RED	012-456	OLB-2300	25088	

Table 8-4. ASSY, Cabinet (P/N 193-1400)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	SCR FLAT HD 2-56 X 5/16 LG 100	NAS662C2R5			
NA	SCR PAN HD 6-32 X 5/8 LG	MS51957-31			
NA	SCR PAN HD 6-32 X 1/2 LG	MS51957-30			
NA	SCR PAN HD 6-32 X 9/16 LG	MS51957-123			
NA	SCR PAN HD 4-40 X 3/16 LG	MS51957-12			
NA	NUT HEX #6	MS35649-264			
NA	NUT HEX #4	MS35649-244			
NA	WASHER LOCK #6	MS35338-136			
NA	WASHER LOCK #4	MS35338-135			
NA	WASHER LOCK #6 EXTERNAL TOOTH	MS35335-58			
NA	SCR FLAT HD 4-40 X 5/8 LG 100	MS24693-C7			
NA	SCR FLAT HD 4-40 X 3/8 LG 100	MS24693-C4			
NA	SCR FLAT HD 4-40 X 5/16 LG 100	MS24693-C3			
NA	SCR FLAT HD 6-32 X 7/16 LG 100	MS24693-C27			
NA	SCR FLAT HD 6-32 X 5/16 LG 100	MS24693-C25			
NA	WASHER FLAT .156 ID .312 OD	MS15795-805			
NA	ASSY REG/SOCKET	193-1410			
NA	ASSY PWR SWITCH	193-1409			
NA	ASSY PWR ENTRY MODULE	193-1408			
NA	BEZEL RETAINER	193-1407			
NA	FRONT TRIM	193-1406			
NA	REAR TRIM	193-1405			
NA	REAR PANEL	193-1404			
NA	CHASSIS	193-1403			
NA	FRAME	193-1402-2			
NA	FRAME	193-1402-1			
NA	BEZEL	193-1401			
NA	ASSY FRONT PANEL/ OVERLAY	193-1100			
NA	LABEL GROUND	090-353			
NA	CLAMP CABLE 3/16 DIA	074-749	8941	8330	
NA	CABLE TIE	074-170-4	TY-34M	56501	
U1	IC VOLTAGE REGULATOR	015-07-LM317K	LM317K	12040	
NA	INSULATOR ELASTOMER TO-3	012-29-48	60-11-4302-16	718565	
A3	PSU SWITCHING 30W DUAL OUTPUT +5V +24V	001-296	2030-3	62506	

Table 8-5. ASSY, CPU PCB (P/N 193-1500-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
U10	IC PAL	193-1502			
U5	IC PROGRAMMABLE	193-1501			
NA	SCHEMATIC DIAGRAM	193-1500-200			
NA	FAB PCB CPU	193-1500-100			
TP1	TEST POINT	074-820	TP-101-10	26364	
J6	HEADER ASSY RIGHT ANGLE 40 POSITION DUAL ROW	062-329-40	2-103024-0	779	
JB1	CONN FEMALE JUMPER 2 POSITION	062-307			
JB2	CONN FEMALE JUMPER 2 POSITION	062-307			
J3	CONN DBL ROW STR POST HEADER .100 CENTERS 24 PIN	062-204-24	1-103169-0	779	
J4	CONN DBL ROW STR POST HEADER .100 CENTERS 24 PIN	062-204-24	1-103169-0	779	
J5	CONN DBL ROW STR POST HEADER .100 CENTERS 16 PIN	062-204-16	103169-6	779	
NA	CONN DBL ROW STR POST HEADER .100 CENTERS 4 PIN	062-200-4	87215-1	779	
XU10	SOCKET, IC 24 PIN .30 SPACING	061-110	SM0-243-S6T	95960	
XU1	SOCKET IC 68 PIN PLCC	061-109	PCC-068T-01	15912	
XU7	SOCKET DIP W/CAP .1 UF 40 PIN	061-106-40	SMI-40-S6G	15912	
XU12	SOCKET DIP W/CAP .1 UF 40 PIN	061-106-40	SMI-40-S6G	15912	
XU4	SOCKET DIP W/CAP .1 UF 28 PIN	061-106-28	SMI-28-S6G	15912	
XU5	SOCKET DIP W/CAP .1 UF 28 PIN	061-106-28	SMI-28-S6G	15912	
XU3	SOCKET DIP W/CAP .1 UF 18 PIN	061-106-20	SMI-20-S6G	15912	
XU8	SOCKET DIP W/CAP .1 UF 18 PIN	061-106-20	SMI-20-S6G	15912	
XU9	SOCKET DIP W/CAP .1 UF 18 PIN	061-106-20	SMI-20-S6G	15912	
XU13	SOCKET DIP W/CAP .1 UF 18 PIN	061-106-20	SMI-20-S6G	15912	
XU17	SOCKET DIP W/CAP .1 UF 18 PIN	061-106-20	SMI-20-S6G	15912	
SW1	SWITCH PC MTG SPST RT ANGLE PUSHBUTTON	055-86	TPA11CG-RAO	91506	
C7	CAP MICA 68PF 500V 5%	034-29-680	CD6ED680J03	88124	

Table 8-5. ASSY, CPU PCB (P/N 193-1500-000) CON'T

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
C1	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C2	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C6	CAP CER .1UF 50V 10%	034-27-104	CK05BX104K	56289	
C3	CAP TANT 47UF 10% 35V	031-112-476	T368D476K035AS	5397	
C5	CAP TANT 10UF 10% 35V	031-112-106	T368C106K035AS	5397	
U14	RES NETWORK ISOLATED 16 PIN DIP 33 2%	028-11-330	4116R-001-330	80294	
U18	RES NETWORK ISOLATED 16 PIN DIP 270 2%	028-11-271	4116R-001-271	80294	
U6	RES NETWORK COMMON 10 PIN SIP 10K 2%	028-09-103	4310R-101-103	80294	
R1	RES METALFILM 90.9K 1% 1/4W	025-33-9092	CCF55-9092F	91637	
R14	RES METALFILM 6.19K 1% 1/4W	025-33-6191	CCF55-6191F	91637	
R2	RES METALFILM 30.1K 1% 1/4W	025-33-3012	CCF55-3012F	91637	
R3	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R4	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R5	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R8	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R9	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R10	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R11	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R12	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
R13	RES METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637	
U12	IC CMOS PRGM KEYBD/DISPLAY CONTROLLER	015-82C79	TMP82C79P-2	2P432	
U2	IC VOLTAGE REFERENCE	015-8211	ICL8211CPA	32293	
U1	IC MICRO-PRCSR CMOS 16 BIT MPV 12 MHZ PLCC PKG	015-80C188	N80C188-12	34649	
U25	IC 8 BIT ANALOG IO SYSTEM	015-7569	AD7569KN	24355	
U15	IC DUAL PERIPHERAL AND DRIVER	015-75451	DS75451N	12040	
U16	IC DUAL PERIPHERAL AND DRIVER	015-75451	DS75451N	12040	

Table 8-5. ASSY, CPU PCB (P/N 193-1500-000)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
U23	IC DUAL PERIPHERAL AND DRIVER	015-75451	DS75451N	12040	
U24	IC DUAL PERIPHERAL AND DRIVER	015-75451	DS75451N	12040	
U9	IC BUS TRANSCEIVER IEEE	015-75161	SN75161BN	1295	
U8	IC BUS TRANSCEIVER IEEE	015-75160	SN75160BN	1295	
U3	IC OCTAL TRANSPARENT LATCH D TYPE TRI STATE CMOS	015-74ACT573	V74ACT573P	9Z527	
U22	IC OCTAL TRANSPARENT LATCH D TYPE TRI STATE CMOS	015-74ACT573	V74ACT573P	9Z527	
U13	IC OCTAL BUS DRIVER	015-74ACT541	V74ACT541P	9Z527	
U17	IC OCTAL BUS TRANSCEIVER TRI STATE NON INVERT	015-74ACT245	V74ACT245P	9Z527	
U7	IC GPIB INTERFACE CONTROLLER	015-7210	UPD7210C	61892	
U4	IC STATIC RAM 32KX8 100 nsF CMOS	015-43256	UPD43256C-10L	61892	
U11	IC CMOS SERIAL EEPROM 2KX8	015-24C16	X24C16P	60395	
Y1	CLOCK OSC 24MHZ CMOS	012-405-12	FSC-24MHZ	61429	
DS1	DIODE LED RED W/RESISTOR	012-314	HLMP-6620	28480	

Table 8-6. ASSY, Power Entry Module (P/N 193-1408)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	WIRE #18 GRN/YEL PVC INSULATED	079-164-1			
NA	WIRE #18 600V GRAY TEFLON	079-145-8			
NA	WIRE, #18 600V RED TEFLON	079-145-2			
NA	WIRE, #18 600V BROWN TEFLON	079-145-1			
P1	TERMINAL RECEPTACLE BULLET INSULATED 22-16 AWG	074-854-1	CVDGF2216T-5	28959	
E1	GROUND LUG #4-40	074-627-3	1416-4	83330	
NA	CONTACT CRIMP 18-24 AWG TIN PLATING LOOSE	062-327-1	08-50-0106	27264	
P2	CONN HSG CRIMP TERM 5 CIRCUIT W/LOCKING RAMP	062-327	09-50-3051	27264	
NA	FUSE DRAWER 1/4 X 11/4 FUSE	051-38-1	SC2N	5245	
XF1	PWR ENTRY MODULE	051-38	3EDSC2-2	5245	

Table 8-7. ASSY, Power Switch (P/N 193-1409)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&R
NA	TUBING SHRINKABLE	079-41-6	FIT-221-3/32CL908958		
NA	CABLE 4-CONDUCTOR	079-172			
P1	TERMINAL BULLET MALE INSULATED 22-16 AWG	074-854-2	FVDGM2216T-5	28959	
E1	TERM, RCPT, CRIMP, .187 X .032	074-835-3	2-520194-2	779	
E2	TERM, RCPT, CRIMP, .187 X .032	074-835-3	2-520194-2	779	
E3	TERM, RCPT, CRIMP, .187 X .032	074-835-3	2-520194-2	779	
S1	SWITCH DPDT ROCKER BLK ON/OFF	055-97	XRM-210N-000	91506	

Table 8-8 ASSY, Regulator/Socket (P/N 193-1410)

REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE	SM&
NA	WIRE #22 ORANGE TEFLON	079-147-3			
NA	WIRE #22 WHT/ORN TEFLON	079-147-17			
NA	WIRE #22 WHT/BLK TEFLON	079-147-11			
P1	CONN HOUSING 3 PIN .156 CENTERS	062-327-2	09-50-3031	27264	
NA	CONTACT CRIMP 18-24 AWG TIN PLATING LOOSE	062-327-1	08-50-0106	27264	
NA	SOCKET TRANSISTOR	061-56	8080-1G1	91506	

SECTION IX
DIAGRAMS AND COMPONENT LOCATION

9-1 GENERAL.

This section contains all the component location, schematics, and interconnection diagrams to be used as an aid in fault isolation and troubleshooting of the Model 8200 Controller. Table 9-1 provides an index of diagrams that are located in this section. Table 9-2 provides a Model 8200 cable interconnect index.

9-2 COMPONENT LOCATION.

The component location diagrams are provided to identify the location of an assembly, module, and/or components located in the Controller. Refer to Section VIII for the associated parts information of each component location drawing found in this section.

9-3 SCHEMATICS AND INTERCONNECTION DIAGRAMS.

The schematic and interconnection diagrams are provided as an aid in understanding the operation of the Model 8200 Controller. Additionally, circuit descriptions for each schematic can be located in Section V.

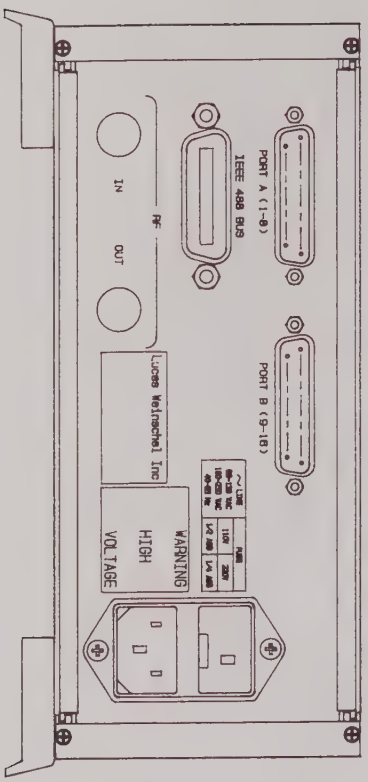
Table 9-1. Cable Interconnection Chart, Model 8200

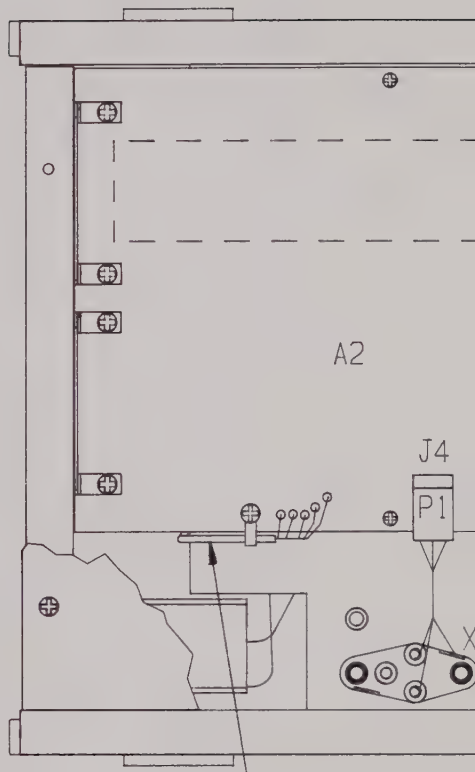
FROM	TO
A1J3	W1P1
A1J4	A3W2P2
A1J5	A3W1P2
A1J6	A2J3
A2P1	PS1J1
U1P1	A2J4

Table 9-1. Model 8200 Diagram Index

Figure No.	Page No.	Diagram Title
9-1	9-3/9-4	Controller (Model 8200)Component Location, P/N 193-1000.
9-2	9-7/9-8	Controller (Model 8200) Schematic Diagram, P/N 193-1000-200.
9-3	9-9/9-10	CPU PCB Assembly (A1) Component Location, P/N 193-1500-000.
9-4	9-11/9-12	CPU PCB Assembly (A1) Schematic Diagram, P/N 193-1500-200.
9-5	9-17/9-18	Driver PCB Assembly (A2) Component Location, P/N 193-1200-000.
9-6	9-19/9-20	Driver PCB Assembly (A2) Schematic Diagram, P/N 193-1200-200.
9-7	9-25/9-26	Switch/LED Status PCB Assembly (A4) Component Location, P/N 193-1300-000.
9-8	9-27/9-28	Switch/LED Status PCB Assembly (A4) Schematic Diagram, P/N 193-1200-200.
9-9	9-31	Power Entry Module Assembly (F1 and XF1) Component Location, P/N 193-1408.
9-10	9-32	Power Switch Assembly (S1) Component Location, P/N 193-1409.
9-11	9-33	Regulator/Socket Assembly (U1 and XU1) Component Location, P/N 193-1410.

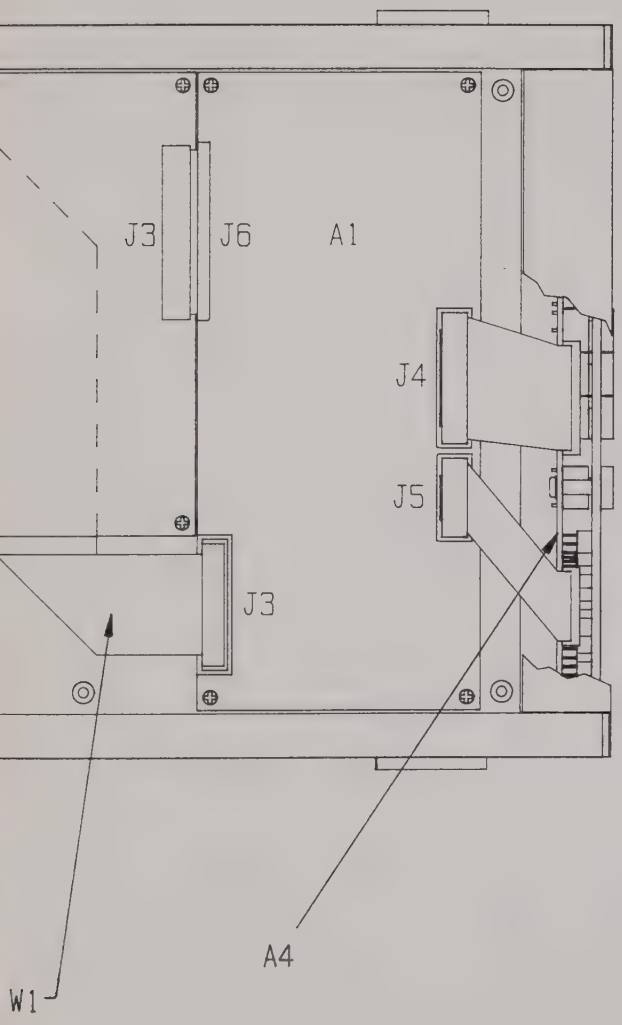
Notes:





WIRE CHART

FROM	TO
A4-J1	A1-J5
A4-J2	A1-J4
XU1-P1	A2-J4
W1-P1	A1-J3
A1-J6	A2-J3
A2-P1	A3-P2



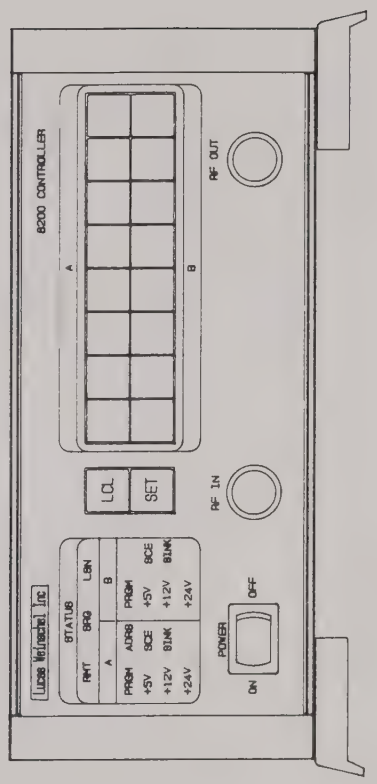
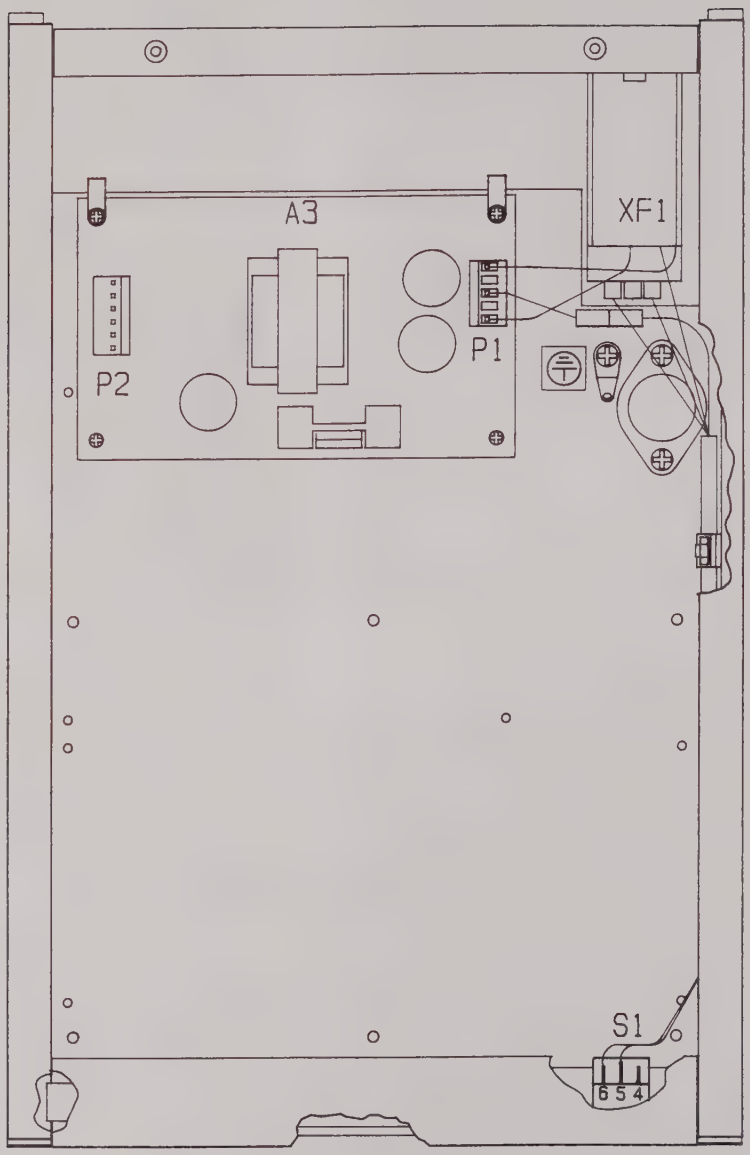
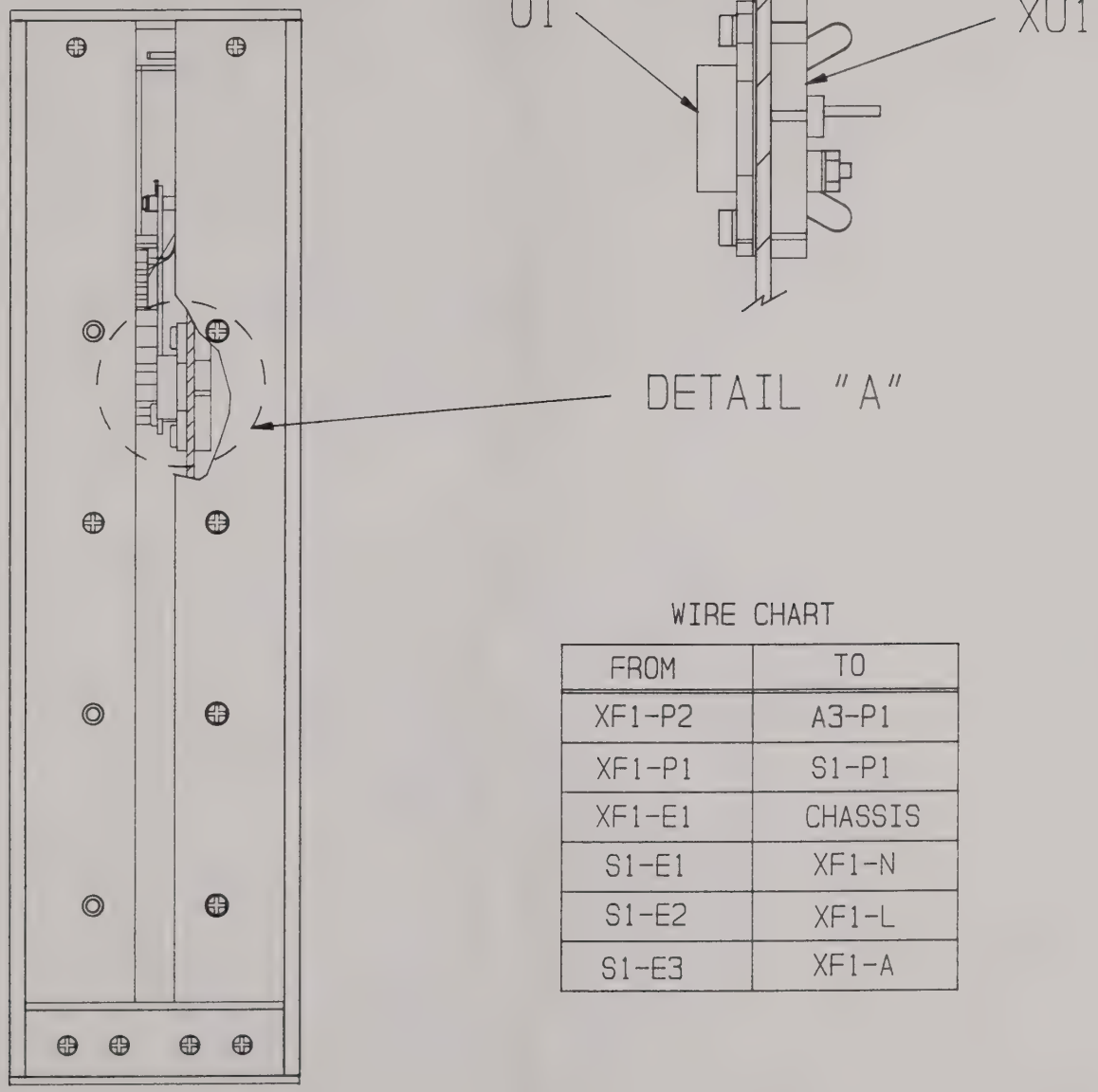


Figure 9-1.
Controller, Model 8200 Component Location, P/N 193-1000 (Sheet 1 of 2).

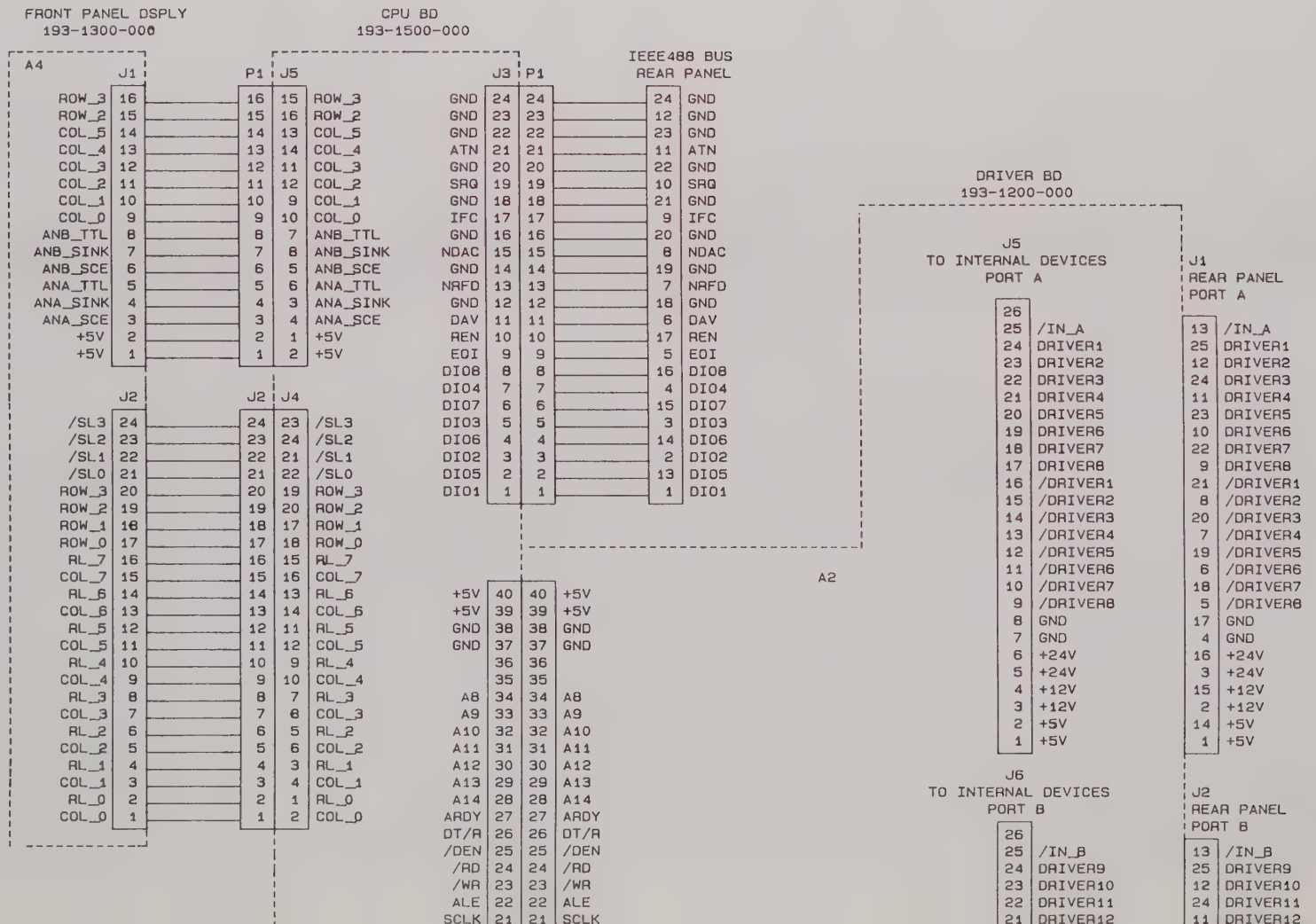

A3
XF1
P2
P1
S1
6 5 4



WIRE CHART

FROM	TO
XF1-P2	A3-P1
XF1-P1	S1-P1
XF1-E1	CHASSIS
S1-E1	XF1-N
S1-E2	XF1-L
S1-E3	XF1-A

Figure 9-1.
Controller, Model 8200 Component Location, P/N 193-1000 (Sheet 2 of 2).


FRONT PANEL DSPLY
193-1300-000
CPU BD
193-1500-000
IEEE488 BUS
REAR PANEL
A4
J1
P1
J5
J3
P1
ROW_3 16 16 15 ROW_3
ROW_2 15 15 16 ROW_2
COL_5 14 14 13 COL_5
COL_4 13 13 14 COL_4
COL_3 12 12 11 COL_3
COL_2 11 11 12 COL_2
COL_1 10 10 9 COL_1
COL_0 9 9 10 COL_0
ANB_TTL 8 8 7 ANB_TTL
ANB_SINK 7 7 8 ANB_SINK
ANB_SCE 6 6 5 ANB_SCE
ANA_TTL 5 5 6 ANA_TTL
ANA_SINK 4 4 3 ANA_SINK
ANA_SCE 3 3 4 ANA_SCE
+5V 2 2 1 +5V
+5V 1 1 2 +5V
GND 24 24 24 GND
GND 23 23 12 GND
GND 22 22 23 GND
ATN 21 21 11 ATN
GND 20 20 22 GND
SRQ 19 19 10 SRQ
GND 18 18 21 GND
IFC 17 17 9 IFC
GND 16 16 20 GND
NDAC 15 15 8 NDAC
GND 14 14 19 GND
NRFD 13 13 7 NRFD
GND 12 12 18 GND
DAV 11 11 6 DAV
REN 10 10 17 REN
EOI 9 9 5 EOI
DIO8 8 8 16 DIO8
DIO4 7 7 4 DIO4
DIO7 6 6 15 DIO7
DIO3 5 5 3 DIO3
DIO6 4 4 14 DIO6
DIO2 3 3 2 DIO2
DIO5 2 2 13 DIO5
DIO1 1 1 1 DIO1
J2
J2
J4
/SL3 24 24 23 /SL3
/SL2 23 23 24 /SL2
/SL1 22 22 21 /SL1
/SL0 21 21 22 /SL0
ROW_3 20 20 19 ROW_3
ROW_2 19 19 20 ROW_2
ROW_1 18 18 17 ROW_1
ROW_0 17 17 18 ROW_0
RL_7 16 16 15 RL_7
COL_7 15 15 16 COL_7
RL_6 14 14 13 RL_6
COL_6 13 13 14 COL_6
RL_5 12 12 11 RL_5
COL_5 11 11 12 COL_5
RL_4 10 10 9 RL_4
COL_4 9 9 10 COL_4
RL_3 8 8 7 RL_3
COL_3 7 7 8 COL_3
RL_2 6 6 5 RL_2
COL_2 5 5 6 COL_2
RL_1 4 4 3 RL_1
COL_1 3 3 4 COL_1
RL_0 2 2 1 RL_0
COL_0 1 1 2 COL_0
+5V 40 40 +5V
+5V 39 39 +5V
GND 38 38 GND
GND 37 37 GND
36 36
35 35
A8 34 34 A8
A9 33 33 A9
A10 32 32 A10
A11 31 31 A11
A12 30 30 A12
A13 29 29 A13
A14 28 28 A14
ARDY 27 27 ARDY
DT/R 26 26 DT/R
/DEN 25 25 /DEN
/RD 24 24 /RD
/WR 23 23 /WR
ALE 22 22 ALE
SCLK 21 21 SCLK
A2
DRIVER BD
193-1200-000
J5
TO INTERNAL DEVICES
PORT A
26
25 /IN_A
24 DRIVER1
23 DRIVER2
22 DRIVER3
21 DRIVER4
20 DRIVER5
19 DRIVER6
18 DRIVER7
17 DRIVER8
16 /DRIVER1
15 /DRIVER2
14 /DRIVER3
13 /DRIVER4
12 /DRIVER5
11 /DRIVER6
10 /DRIVER7
9 /DRIVER8
8 GND
7 GND
6 +24V
5 +24V
4 +12V
3 +12V
2 +5V
1 +5V
J1
REAR PANEL
PORT A
13 /IN_A
25 DRIVER1
12 DRIVER2
24 DRIVER3
11 DRIVER4
23 DRIVER5
10 DRIVER6
22 DRIVER7
9 DRIVER8
21 /DRIVER1
8 /DRIVER2
20 /DRIVER3
7 /DRIVER4
19 /DRIVER5
6 /DRIVER6
18 /DRIVER7
5 /DRIVER8
17 GND
4 GND
16 +24V
3 +24V
15 +12V
2 +12V
14 +5V
1 +5V
J6
TO INTERNAL DEVICES
PORT B
26
25 /IN_B
24 DRIVER9
23 DRIVER10
22 DRIVER11
21 DRIVER12
J2
REAR PANEL
PORT B
13 /IN_B
25 DRIVER9
12 DRIVER10
24 DRIVER11
11 DRIVER12

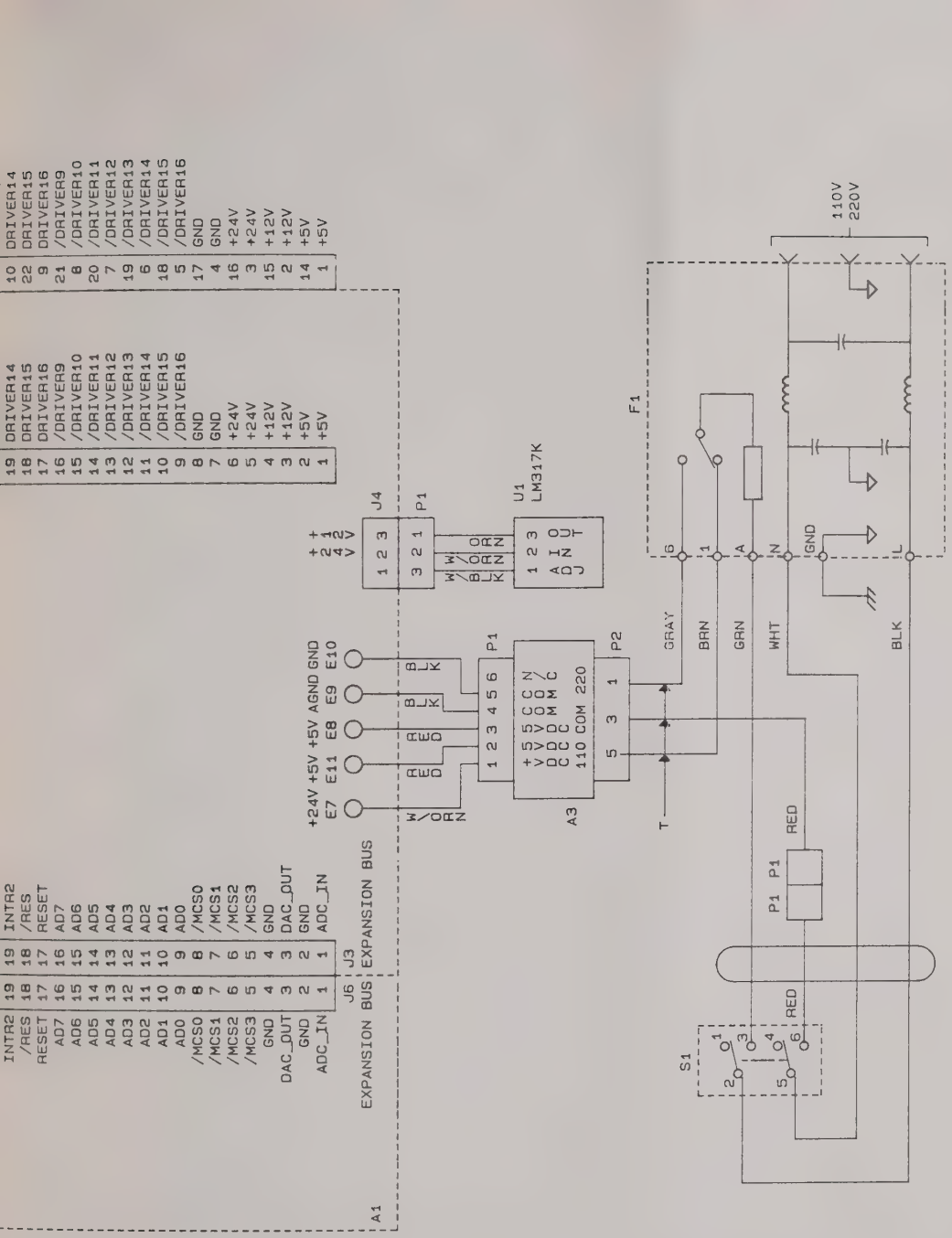
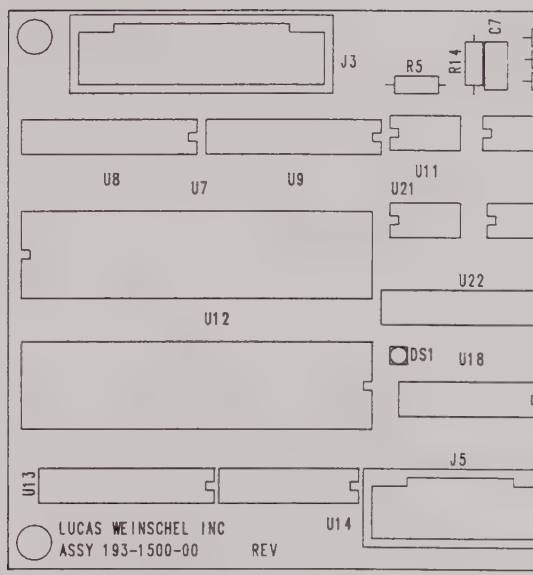


Figure 9-2.
Controller (Model 8200) Schematic Diagram, P/N 193-1000-200


J3
R5
R14
C7
U8
U7
U9
U11
U21
U22
U12
DS1
U18
J5
U13
U14
LUCAS WEINSCHEL INC
ASSY 193-1500-00
REV

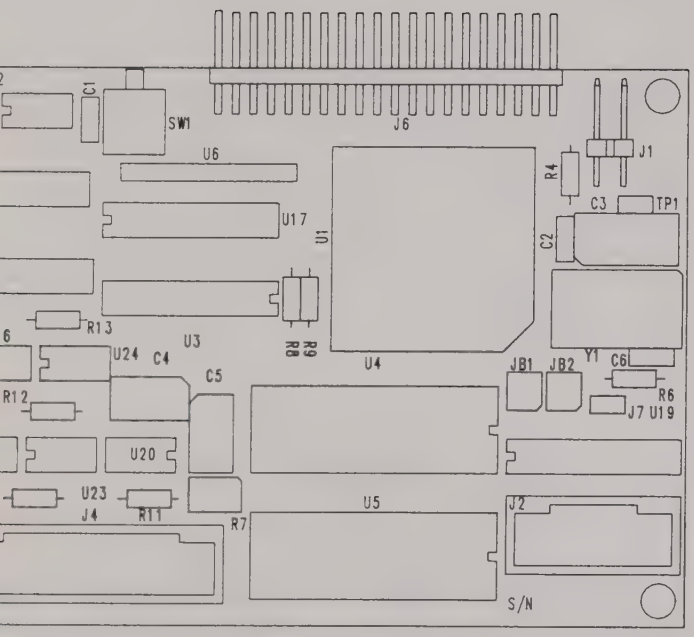
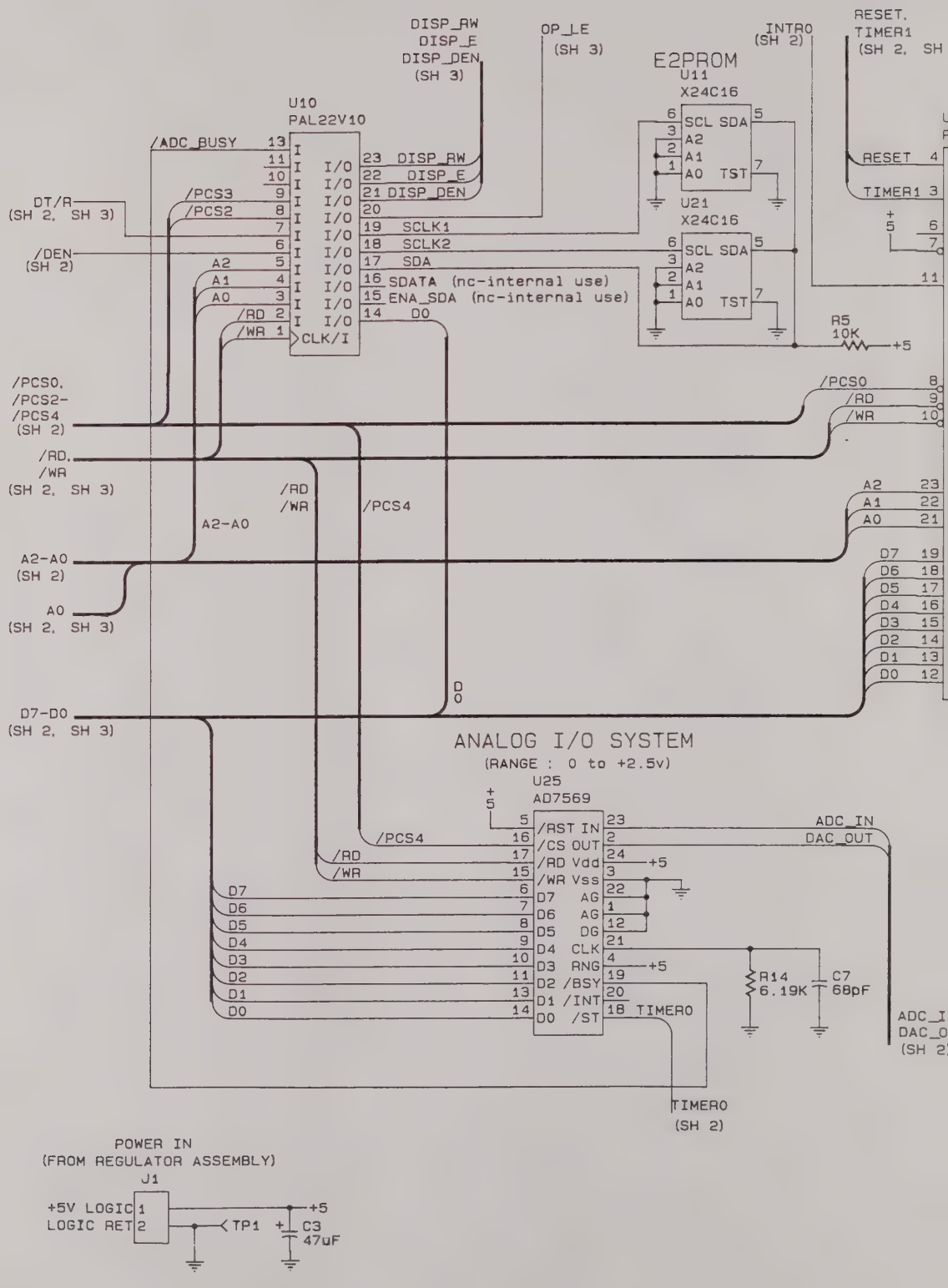
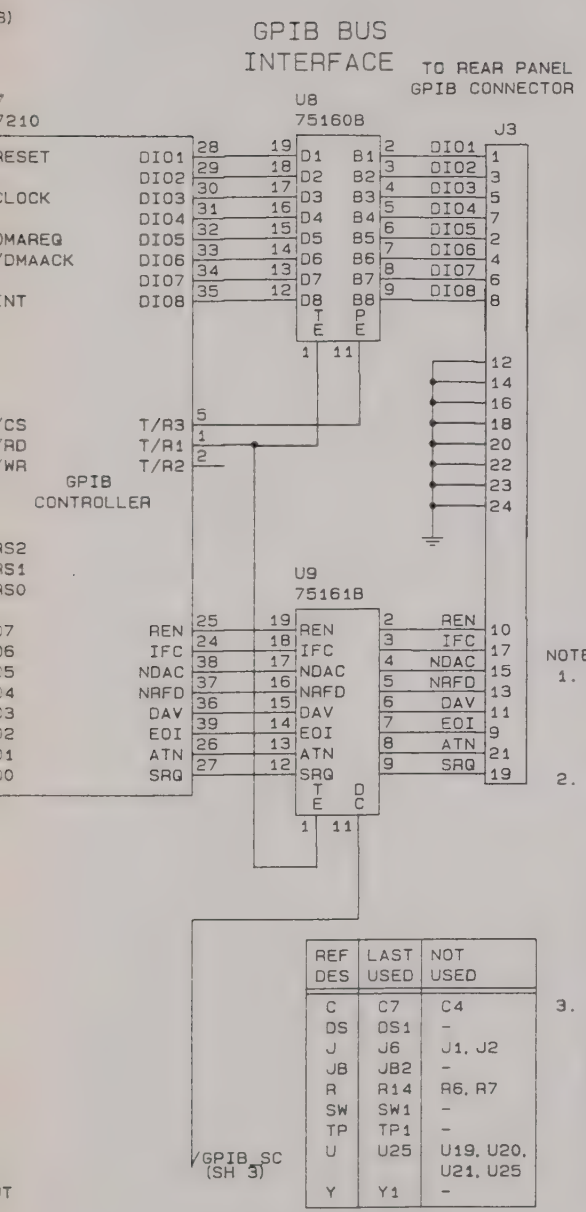


Figure 9-3.
CPU PCB Assembly (A1) Component Location, P/N 193-1500-000


DISP_RW
DISP_E
DISP_DEN
(SH 3)
OP_LE
(SH 3)
INTR0
(SH 2)
RESET,
TIMER1
(SH 2, SH
E2PROM
U11
X24C16
U21
X24C16
SCL SDA
A2
A1
A0 TST
U10
PAL22V10
/ADC_BUSY
DT/R
(SH 2, SH 3)
/DEN
(SH 2)
/PCS3
/PCS2
A2
A1
A0
/RD
/WR
CLK/I
I/O
DISP_RW
DISP_E
DISP_DEN
SCLK1
SCLK2
SDA
SDATA (nc-internal use)
ENA_SDA (nc-internal use)
D0
RESET
TIMER1
R5
10K
+5
/PCS0,
/PCS2-
/PCS4
(SH 2)
/RD,
/WR
(SH 2, SH 3)
/PCS0
/RD
/WR
A2-A0
(SH 2)
A0
(SH 2, SH 3)
D7-D0
(SH 2, SH 3)
D7
D6
D5
D4
D3
D2
D1
D0
ANALOG I/O SYSTEM
(RANGE : 0 to +2.5v)
U25
AD7569
/RST IN
/CS OUT
/RD Vdd
/WR Vss
AG
DG
CLK
RNG
/BSY
/INT
/ST
TIMER0
ADC_IN
DAC_OUT
R14
6.19K
C7
68pF
POWER IN
(FROM REGULATOR ASSEMBLY)
J1
+5V LOGIC
LOGIC RET
TP1
C3
47uF



REF DES	+5V	GND
U1	–	–
U2	–	–
U3	20	10
U4	28	14
U5	28	14
U6	–	–
U7	40	20
U8	20	10
U9	20	10
U10	24	12
U11	–	–
U12	40	20
U13	20	10
U14	–	–
U15	–	–
U16	–	–
U17	20	10
U18	–	
U19	20	10
U20	–	–
U21	–	–
U22	20	10
U23	–	–
U24	–	–
U25	–	–

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS, 1/4W, 1%
   ALL CAPACITORS ARE IN MICROFARADS
2. OPTIONS FOR JUMPER BLOCKS

DEVICE TYPE	JB1
62256 (32K*8)	1-2
6264 (8Kx8)	3-4

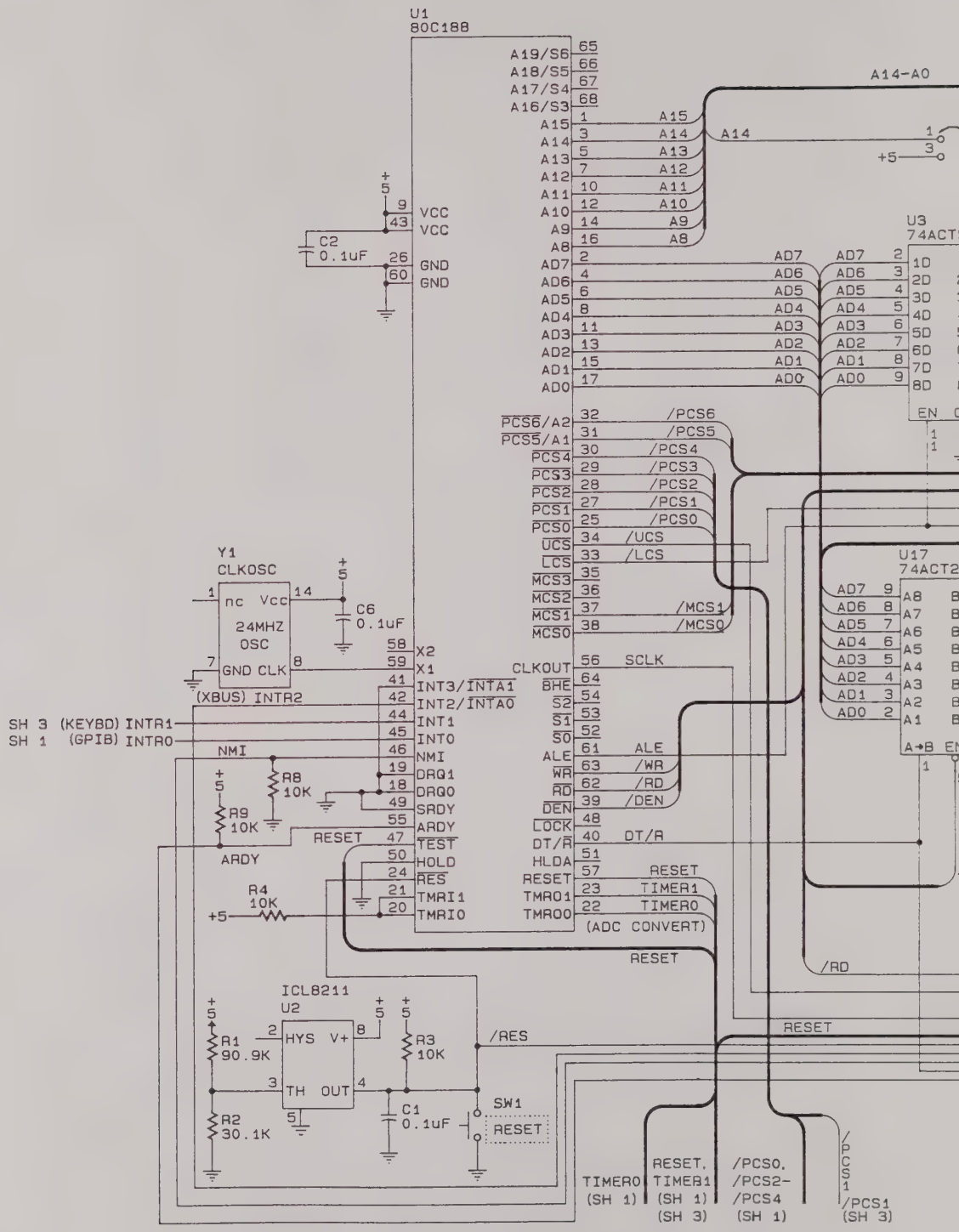
DEVICE TYPE	JB2
27256 (32Kx8)	1-2
27512 (64Kx8)	3-4

3. EITHER X2404 (512x8) OR X24C16 (2KX8) DEVICES MAY BE INSTALLED IN U11 AND U21 SOCKETS

U11	U21	TOTAL STORAGE
2404	2404	1K (512+512)
2404	24C16	2.5K (512+2K)
24C16	24C16	4K (2K+2K)

REF DES	LAST USED	NOT USED
C	C7	C4
DS	DS1	–
J	J6	J1, J2
JB	JB2	–
R	R14	R6, R7
SW	SW1	–
TP	TP1	–
U	U25	U19, U20, U21, U25
Y	Y1	–

Figure 9-4.
CPU PCB Assembly (A1) Schematic Diagram, P/N 193-1500-200 (Sheet 1 of 3)


U1
80C188
A19/S6
A18/S5
A17/S4
A16/S3
A15
A14
A13
A12
A11
A10
A9
A8
AD7
AD6
AD5
AD4
AD3
AD2
AD1
AD0
A14-A0
VCC
VCC
GND
GND
C2
0.1uF
U3
74ACT
/PCS6
/PCS5
/PCS4
/PCS3
/PCS2
/PCS1
/PCS0
/UCS
/LCS
/MCS1
/MCS0
Y1
CLKOSC
nc Vcc
24MHZ
OSC
GND CLK
C6
0.1uF
X2
X1
U17
74ACT2
SH 3 (KEYBD) INTR1
SH 1 (GPIB) INTR0
(XBUS) INTR2
INT3/INTA1
INT2/INTA0
INT1
INT0
NMI
DRQ1
DRQ0
SRDY
ARDY
TEST
HOLD
RES
TMRI1
TMRI0
CLKOUT
BHE
S2
S1
S0
ALE
WR
RD
DEN
LOCK
DT/R
HLDA
RESET
TMRO1
TMRO0
SCLK
/WR
/RD
/DEN
DT/R
(ADC CONVERT)
R8
10K
R9
10K
R4
10K
ICL8211
U2
HYS
V+
TH
OUT
R1
90.9K
R2
30.1K
R3
10K
C1
0.1uF
SW1
RESET
/RES
TIMER0
(SH 1)
RESET,
TIMER1
(SH 1)
(SH 3)
/PCS0,
/PCS2-
/PCS4
(SH 1)
/PCS1
(SH 3)

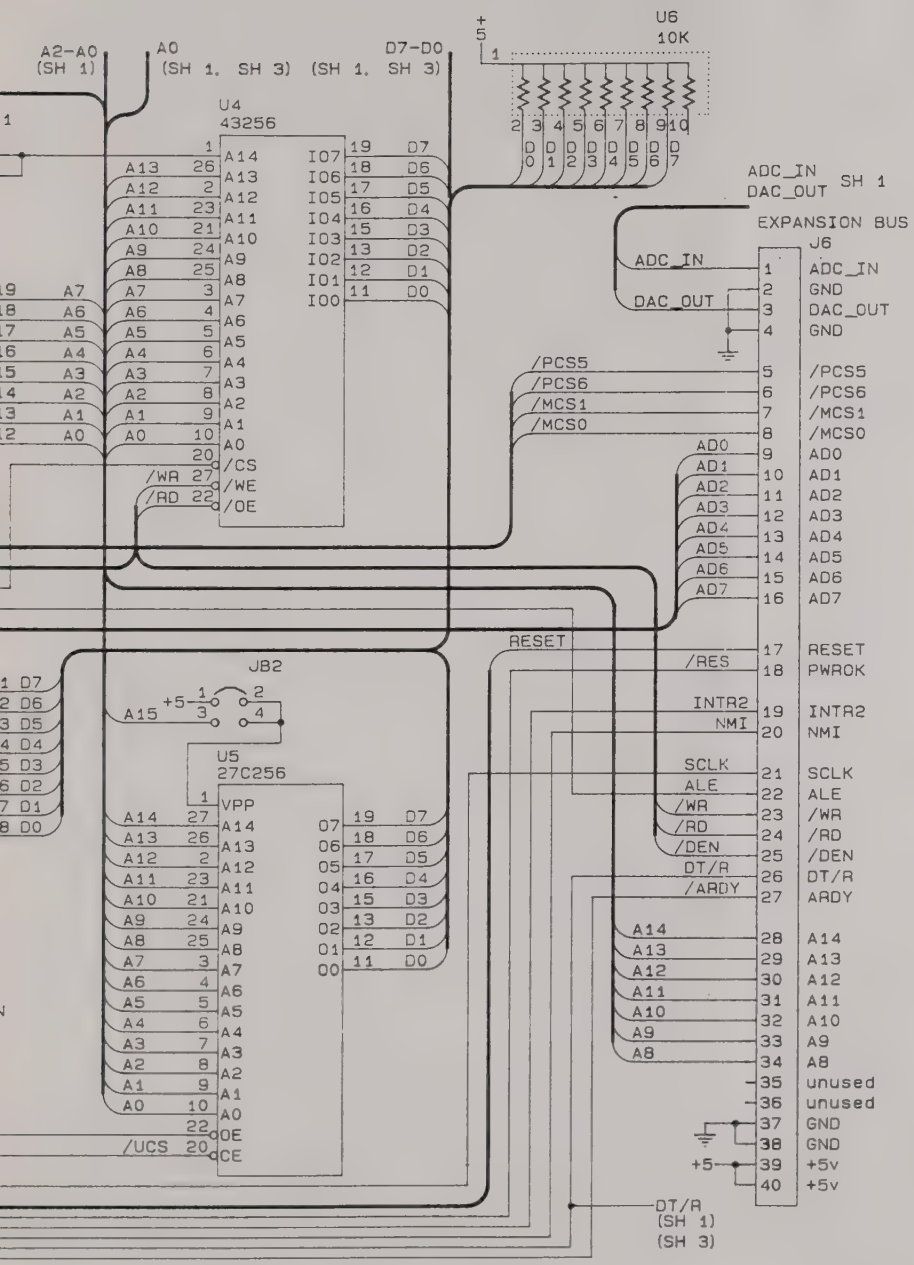
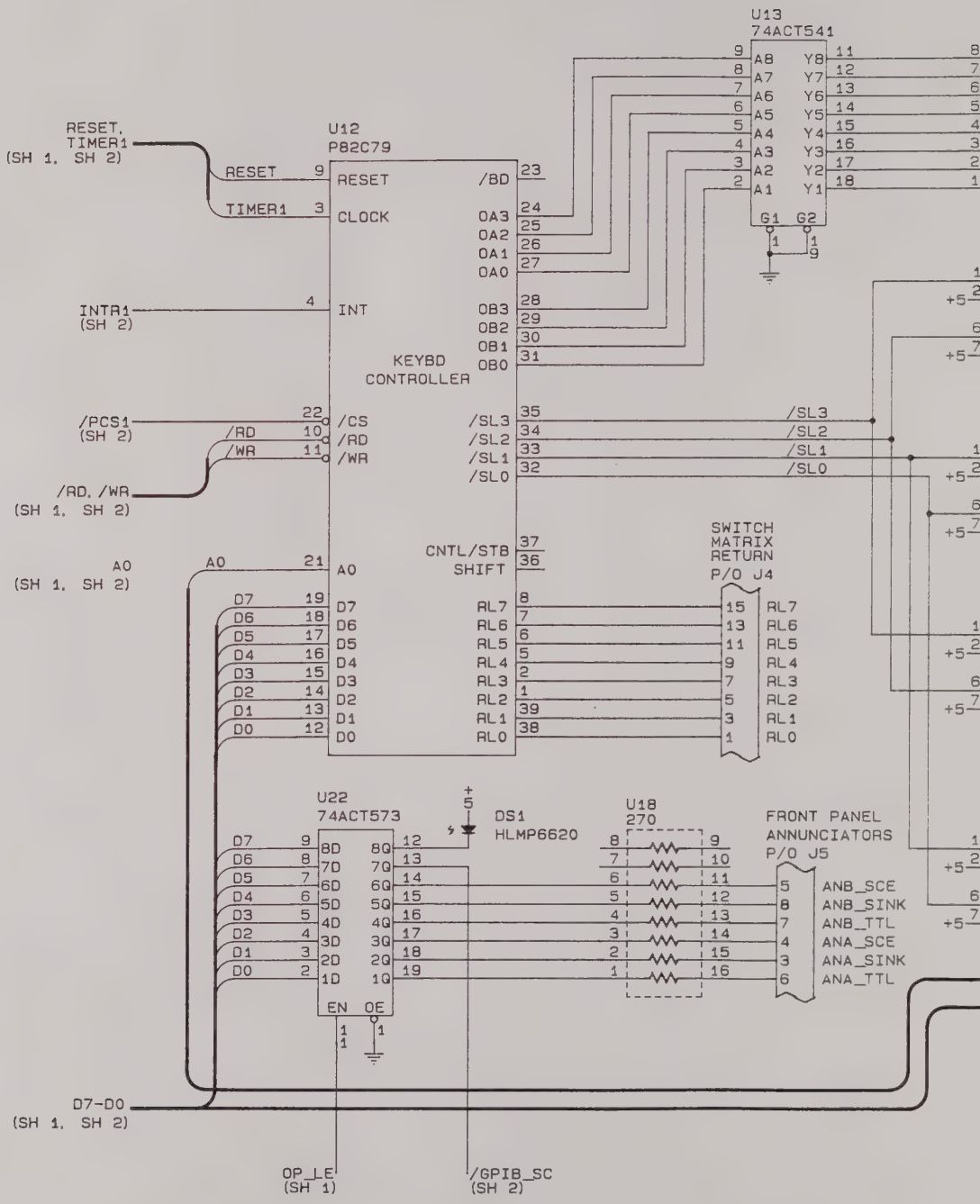


Figure 9-4.
CPU PCB Assembly (A1) Schematic Diagram,
P/N 193-1500-200 (Sheet 2 of 3)


U13
74ACT541
U12
P82C79
RESET, TIMER1 (SH 1, SH 2)
RESET
TIMER1
CLOCK
INTR1 (SH 2)
INT
KEYBD CONTROLLER
/PCS1 (SH 2)
/RD
/WR
/RD, /WR (SH 1, SH 2)
/CS
/RD
/WR
A0 (SH 1, SH 2)
A0
D7
D6
D5
D4
D3
D2
D1
D0
/BD
OA3
OA2
OA1
OA0
OB3
OB2
OB1
OB0
/SL3
/SL2
/SL1
/SL0
CNTL/STB
SHIFT
RL7
RL6
RL5
RL4
RL3
RL2
RL1
RL0
SWITCH MATRIX RETURN
P/O J4
U22
74ACT573
DS1
HLMP6620
U18
270
FRONT PANEL ANNUNCIATORS
P/O J5
ANB_SCE
ANB_SINK
ANB_TTL
ANA_SCE
ANA_SINK
ANA_TTL
D7-D0 (SH 1, SH 2)
OP_LE (SH 1)
/GPIB_SC (SH 2)

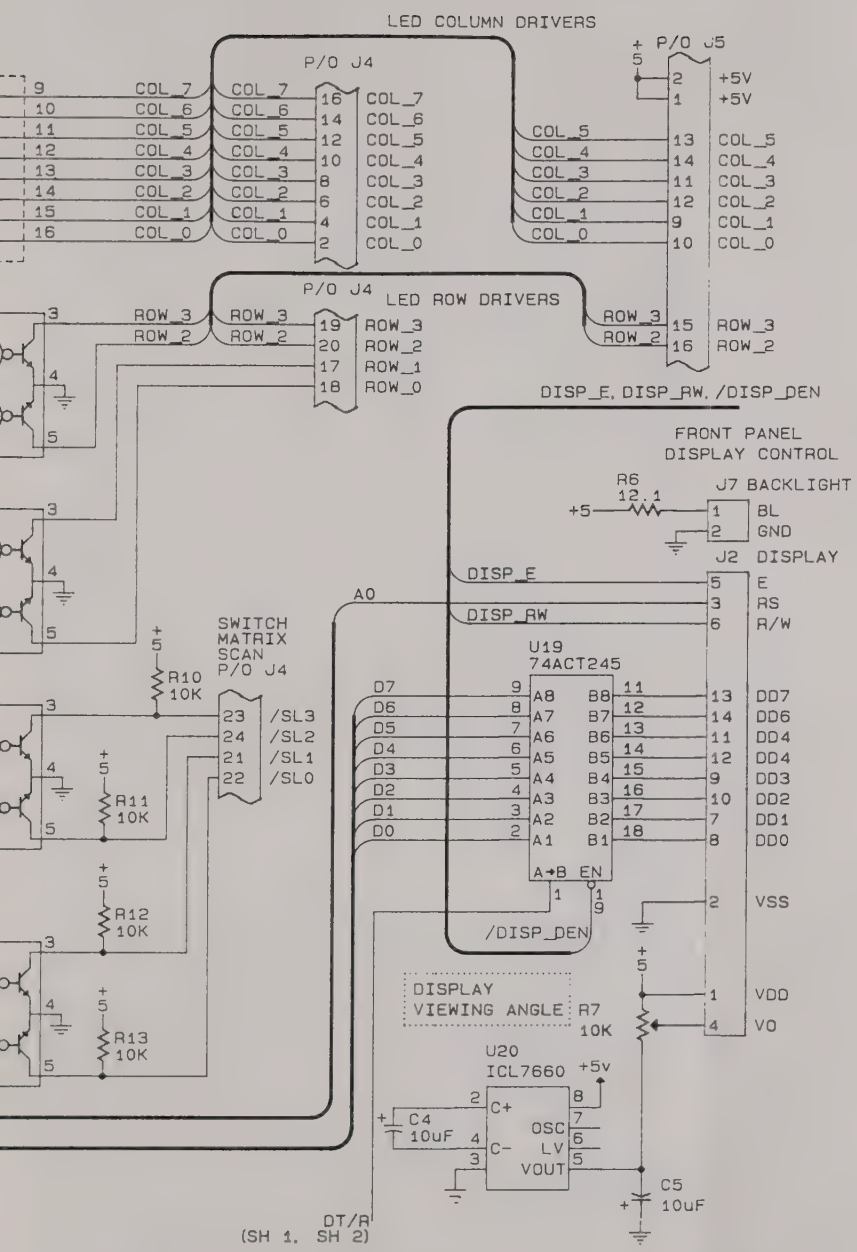
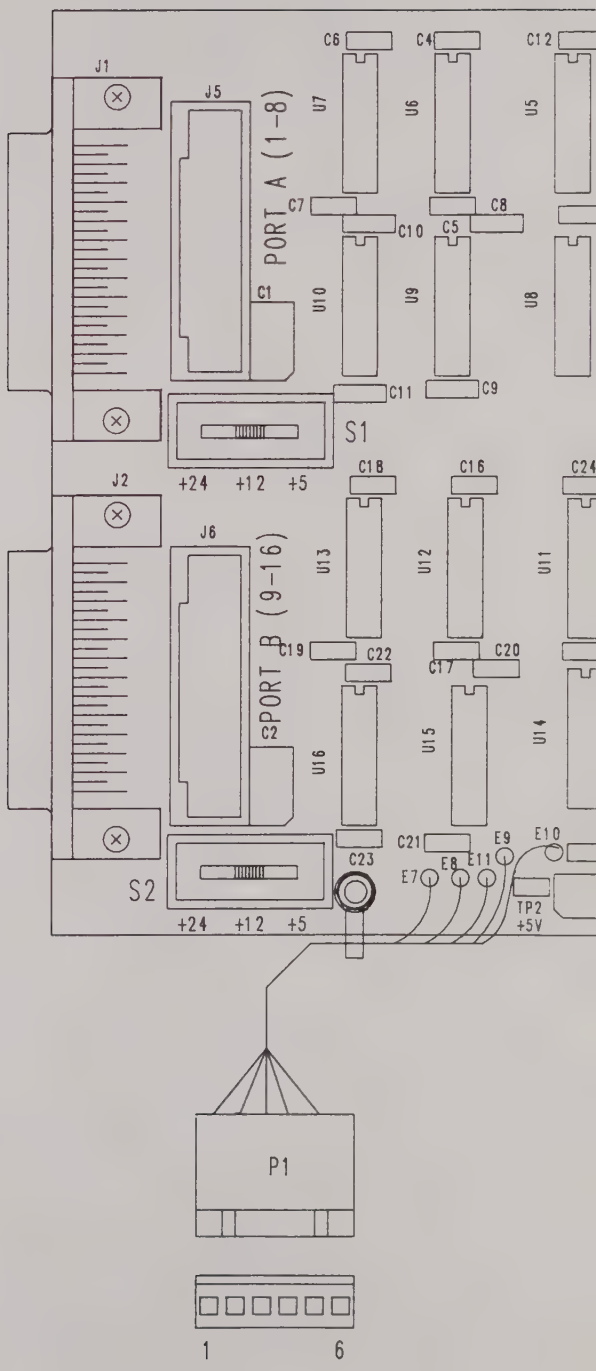


Figure 9-4.
CPU PCB Assembly (A1) Schematic Diagram, P/N 193-1500-200 (Sheet 3 of 3)


J1
J5
PORT A (1-8)
C1
C2
C4
C5
C6
C7
C8
C9
C10
C11
C12
U5
U6
U7
U8
U9
U10
S1
+24
+12
+5
J2
J6
PORT B (9-16)
C16
C17
C18
C19
C20
C21
C22
C23
C24
U11
U12
U13
U14
U15
U16
S2
E7
E8
E9
E10
E11
TP2
+5V
P1
1
6

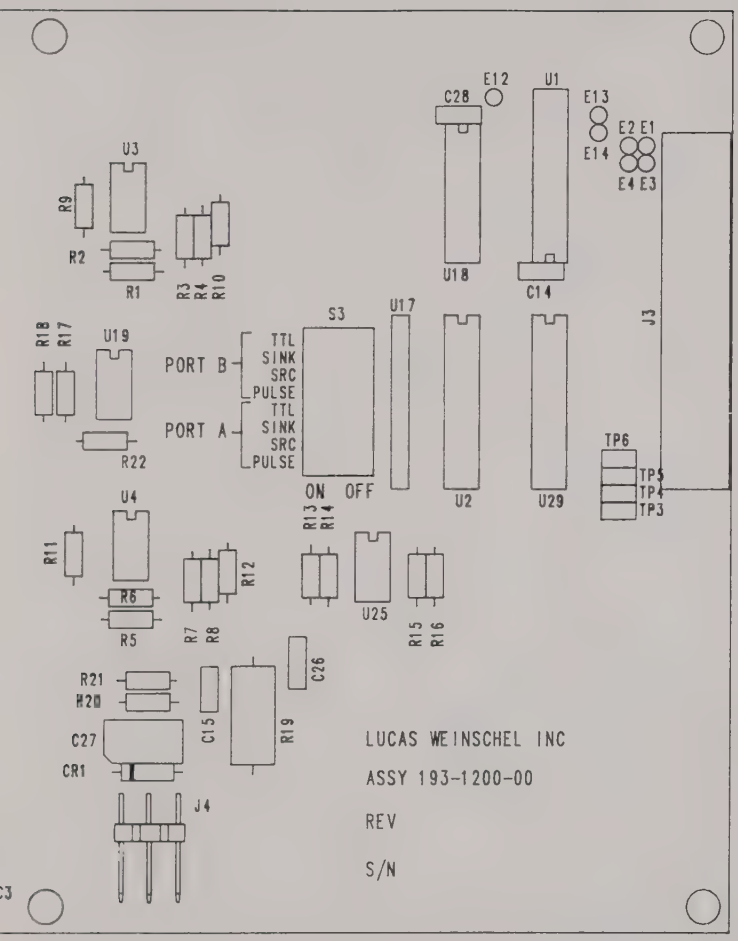
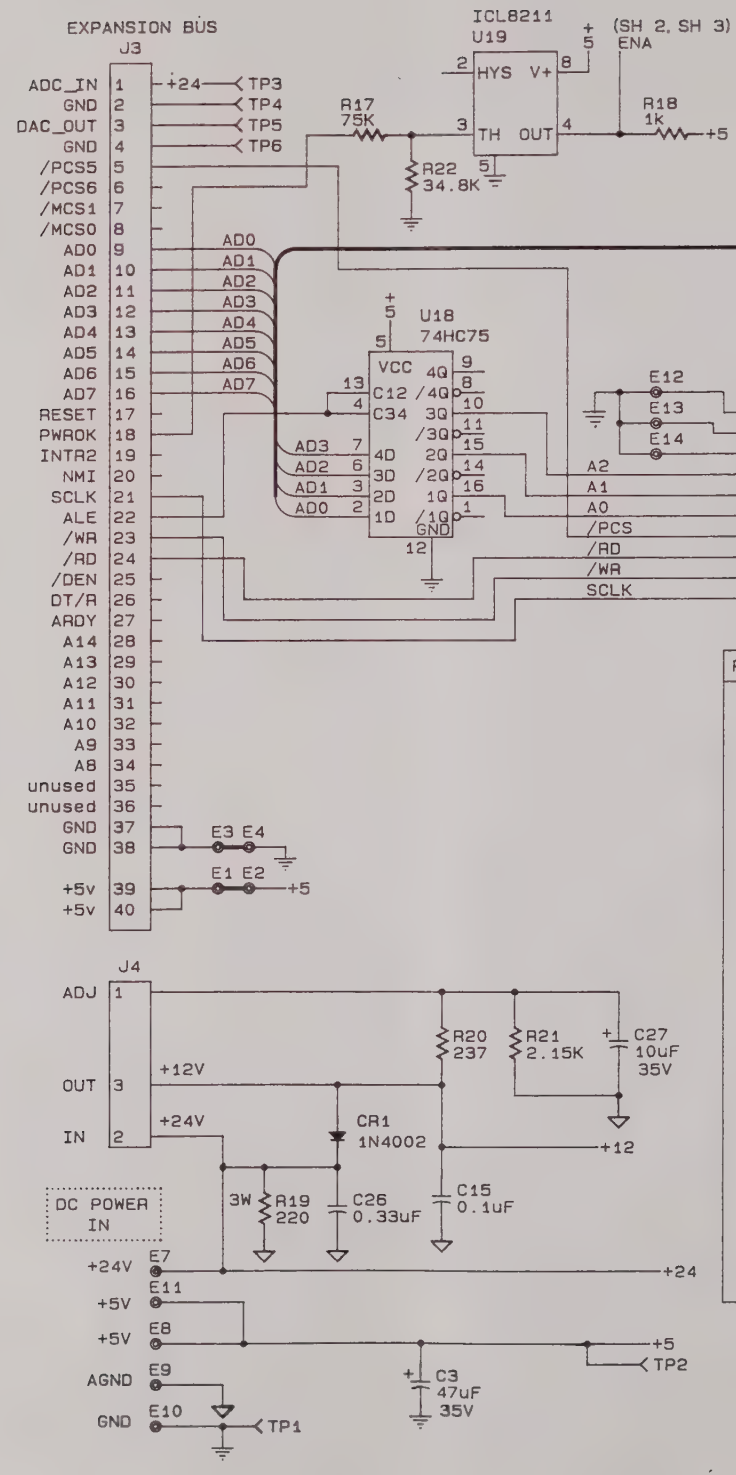
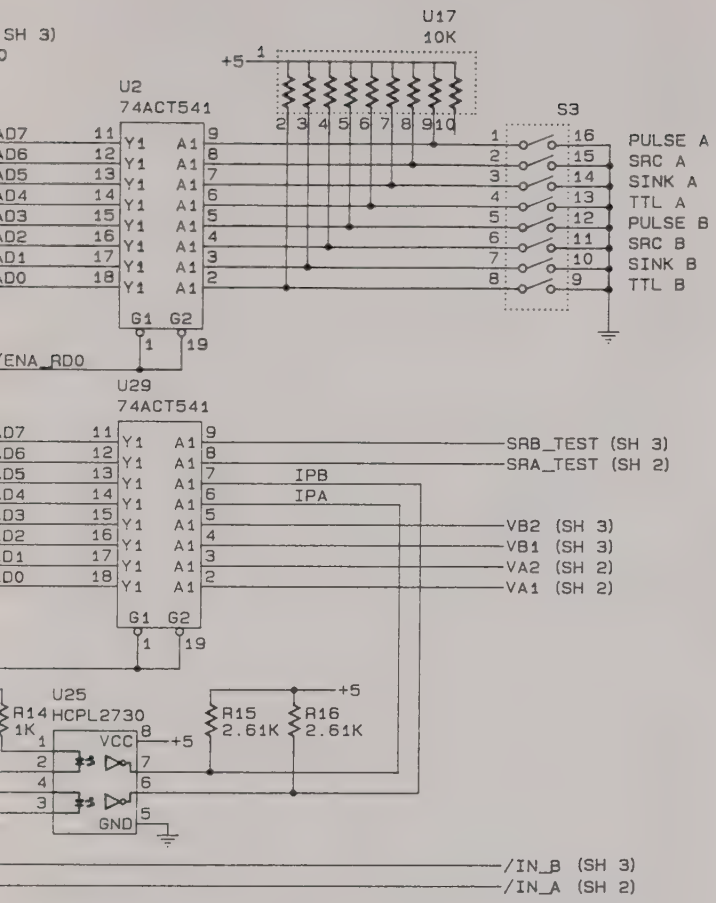


Figure 9-5.
Driver PCB Assembly (A2) Component Location, P/N 193-1200-000



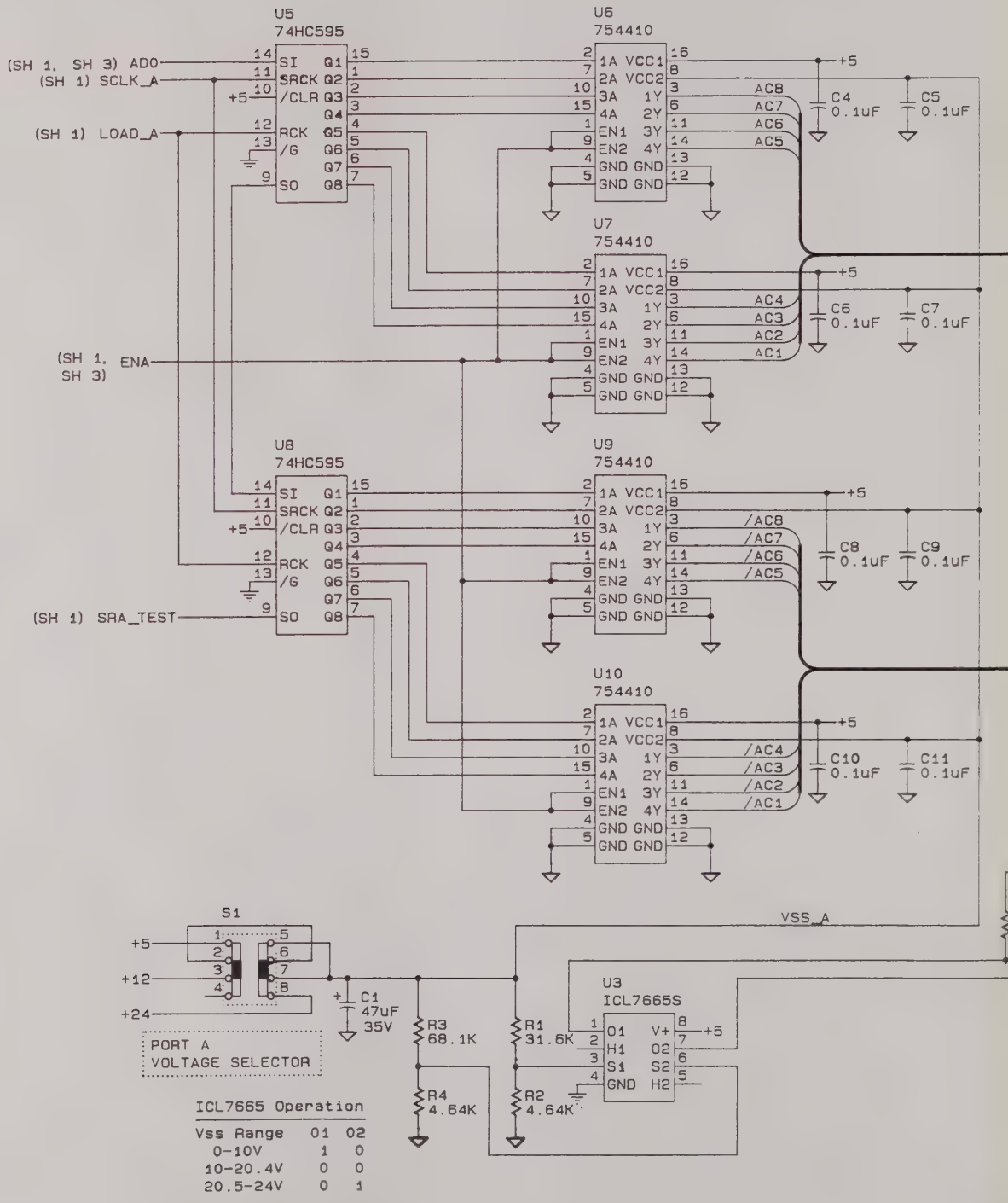
REF DES	GND	+5V	
U1	10	20	
U2	10	20	
U3	-	-	
U4	-	-	
U5	8	16	C12
U6	-	-	
U7	-	-	
U8	8	16	C13
U9	-	-	
U10	-	-	
U11	8	16	C24
U12	-	-	
U13	-	-	
U14	8	16	C25
U15	-	-	
U16	-	-	
U17	-	-	
U18	-	-	
U19	-	-	
U20	NOT USED		
U21	NOT USED		
U22	NOT USED		
U23	NOT USED		
U24	NOT USED		
U25	-	-	
U26	NOT USED		
U27	NOT USED		
U28	NOT USED		
U28	10	20	



SS OTHERWISE SPECIFIED:
RESISTORS ARE 1/4W. 1%

LAST USED	NOT USED
C28	-
CR1	-
E14	E5, E6
J6	-
R22	-
S3	-
TP2	-
U29	U20-U24, U26-U28

Figure 9-6.
Driver PCB Assembly (A2) Schematic Diagram, P/N 193-1200-200 (Sheet 1 of 3)


U5
74HC595
U6
754410
U7
754410
U8
74HC595
U9
754410
U10
754410
(SH 1, SH 3) ADO
(SH 1) SCLK_A
(SH 1) LOAD_A
(SH 1, SH 3) ENA
(SH 1) SRA_TEST
+5
AC8
AC7
AC6
AC5
AC4
AC3
AC2
AC1
/AC8
/AC7
/AC6
/AC5
/AC4
/AC3
/AC2
/AC1
C4 0.1uF
C5 0.1uF
C6 0.1uF
C7 0.1uF
C8 0.1uF
C9 0.1uF
C10 0.1uF
C11 0.1uF
S1
+12
+24
PORT A
VOLTAGE SELECTOR
C1
47uF
35V
R3
68.1K
R4
4.64K
R1
31.6K
R2
4.64K
U3
ICL7665S
VSS_A
ICL7665 Operation
Vss Range 01 02
0-10V 1 0
10-20.4V 0 0
20.5-24V 0 1

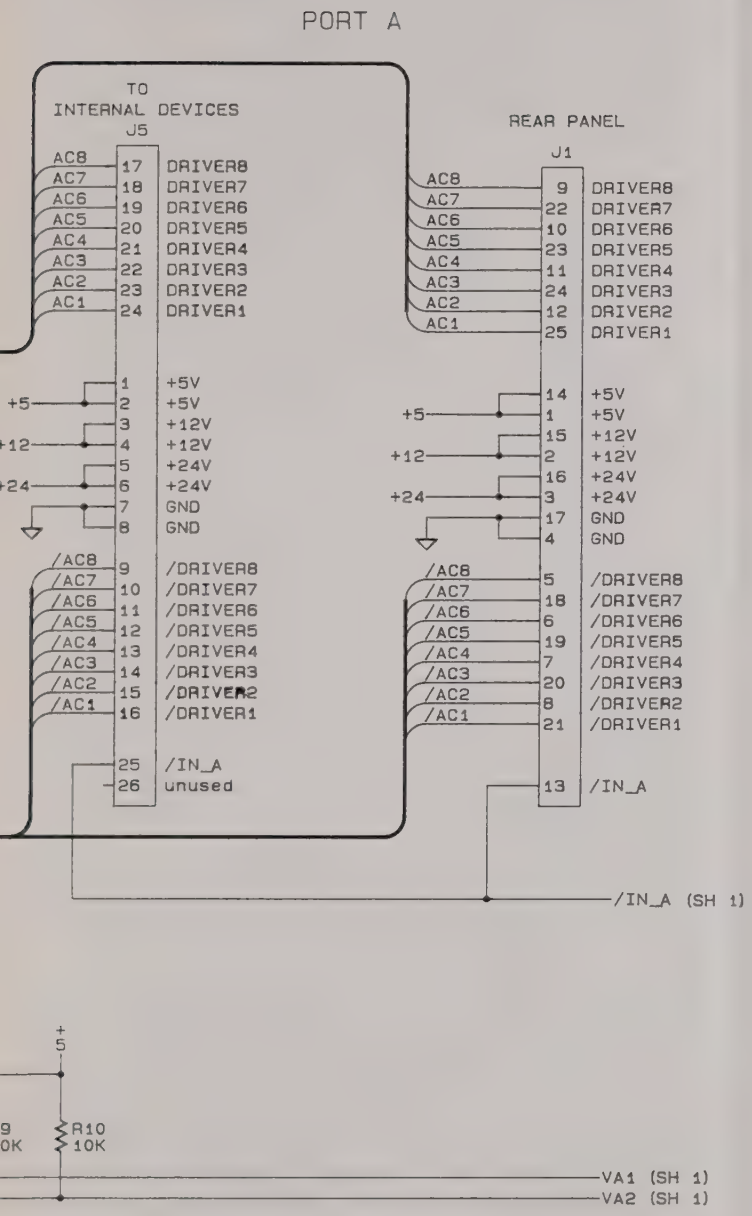
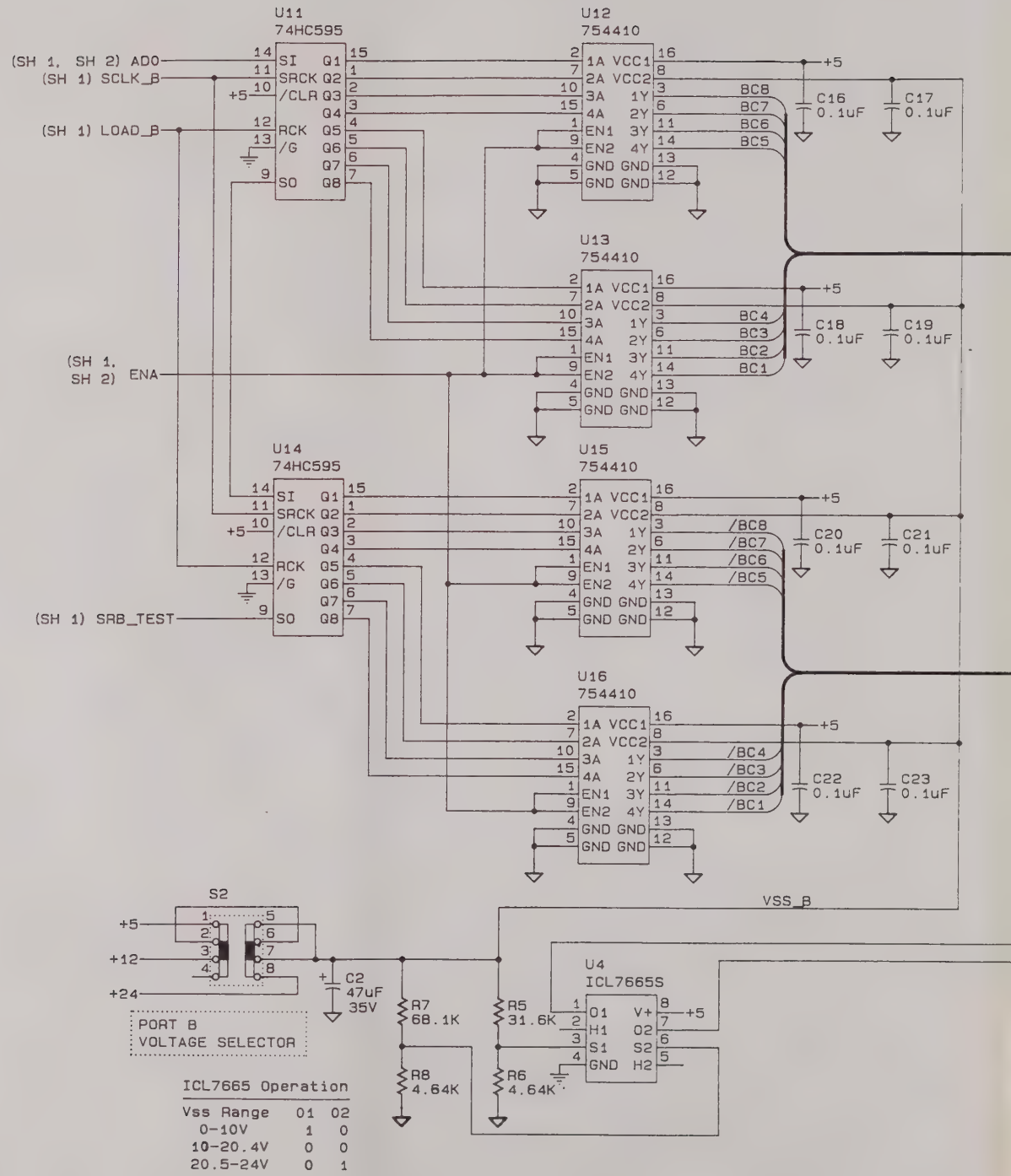


Figure 9-6.
Driver PCB Assembly (A2) Schematic Diagram, P/N 193-1200-200 (Sheet 2 of 3)



ICL7665 Operation

Vss Range	01	02
0-10V	1	0
10-20.4V	0	0
20.5-24V	0	1

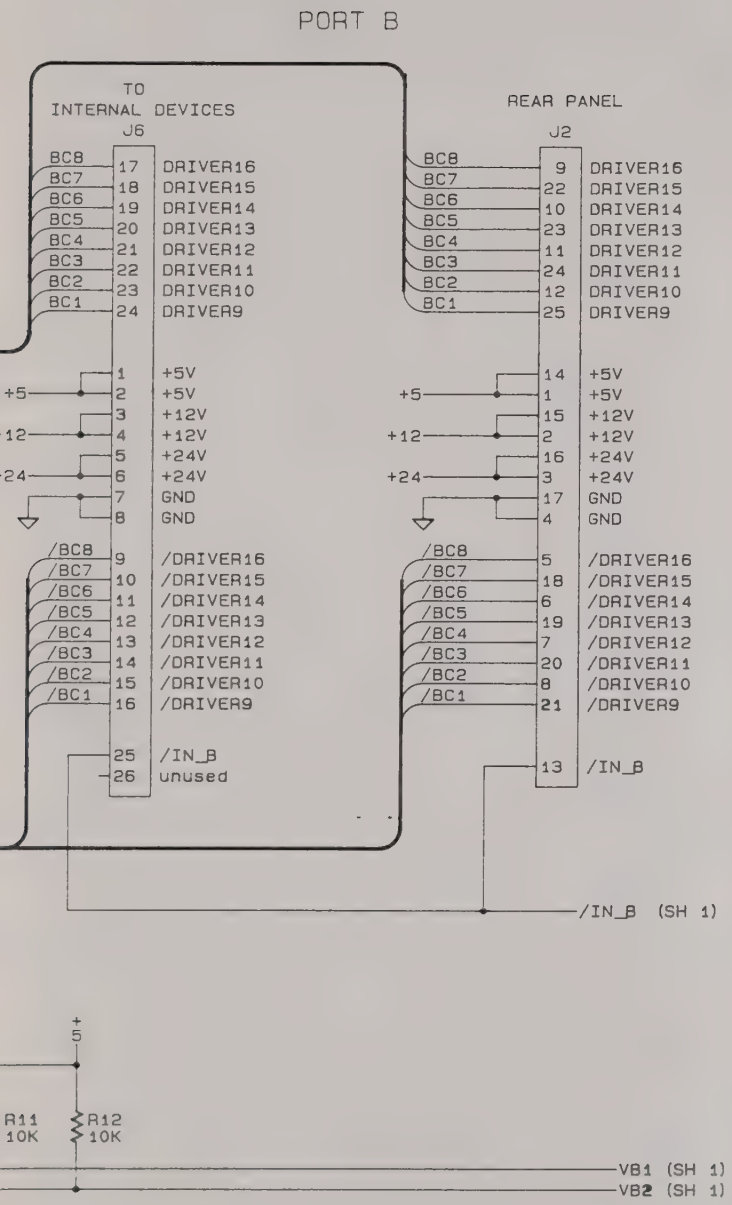
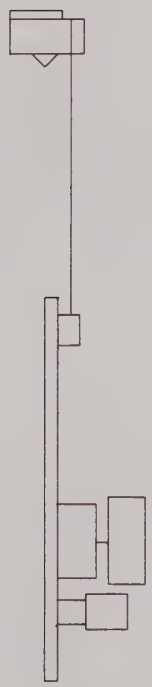
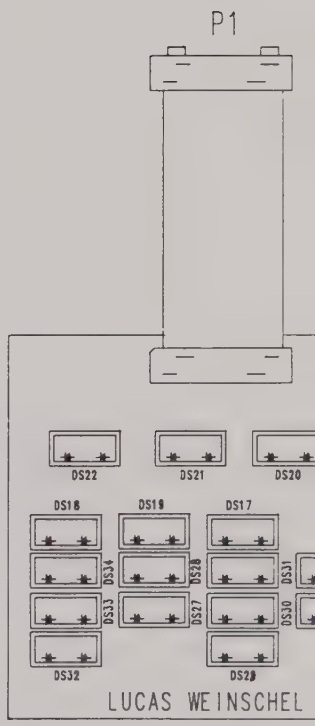


Figure 9-6.
Driver PCB Assembly (A2) Schematic Diagram, P/N 193-1200-200 (Sheet 3 of 3)




P1
DS22
DS21
DS20
DS18
DS19
DS17
DS34
DS28
DS31
DS33
DS27
DS30
DS32
DS29
LUCAS WEINSCHEL

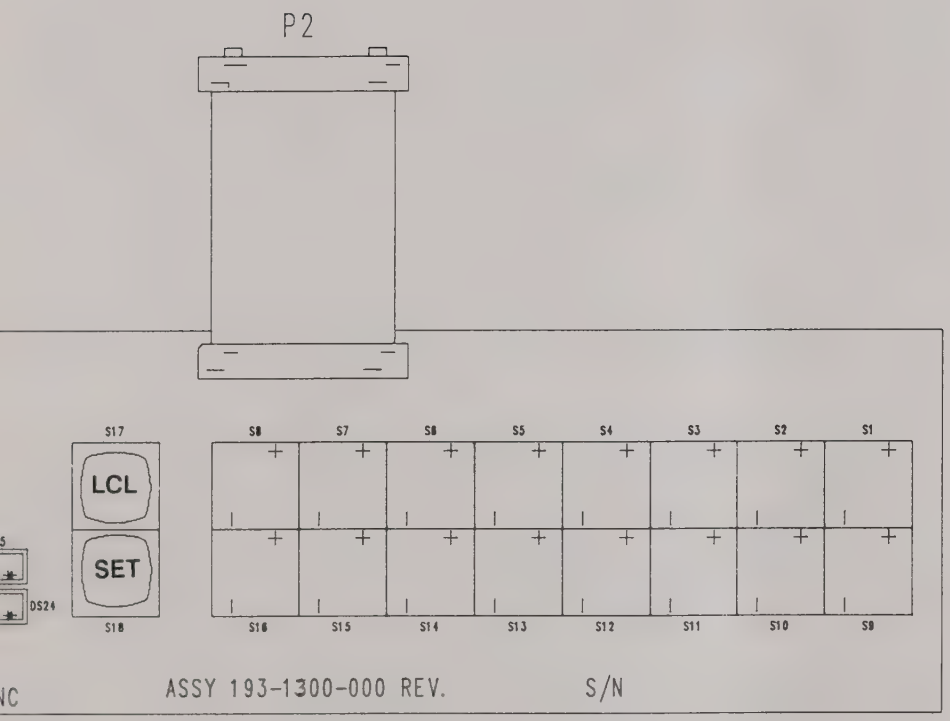
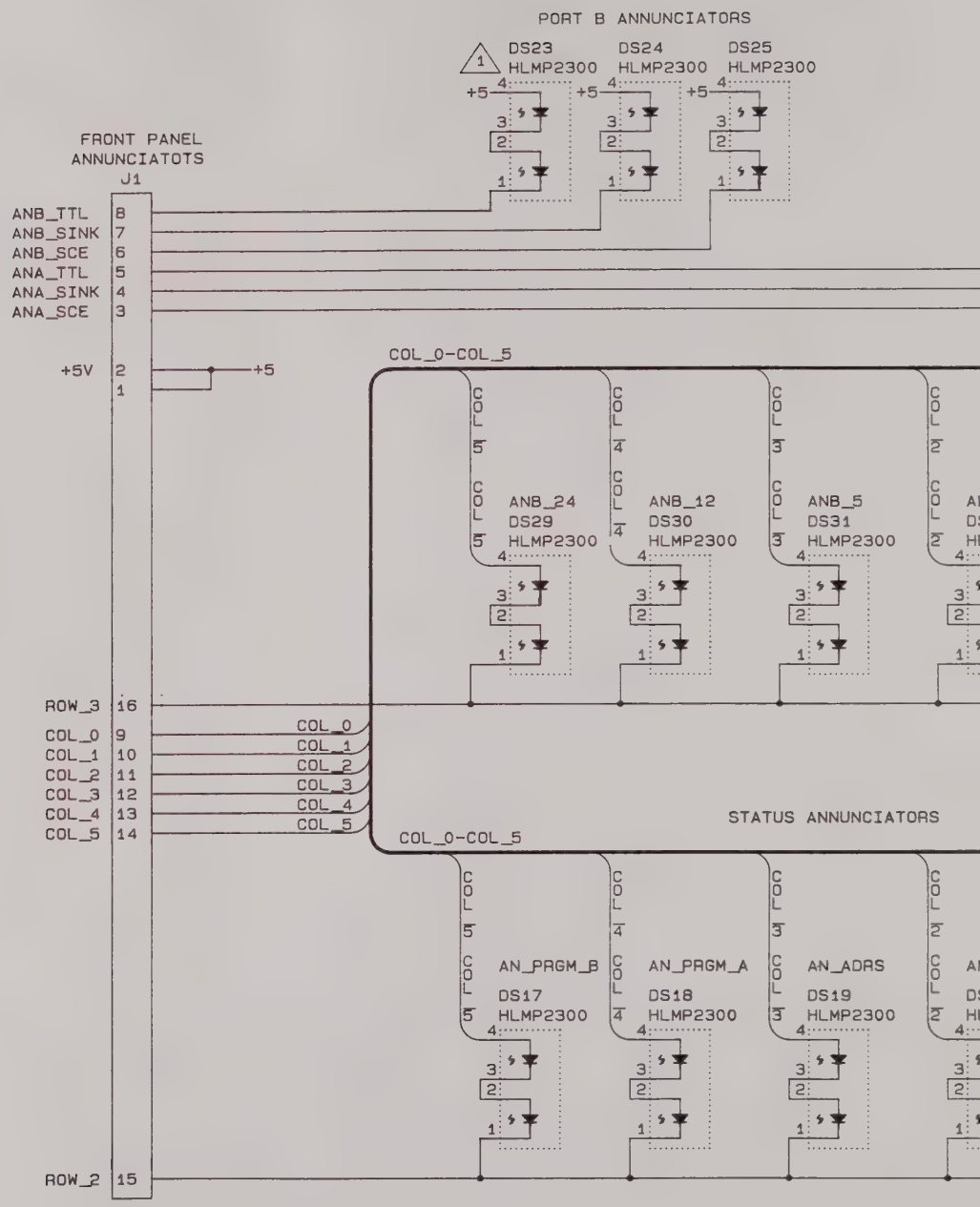
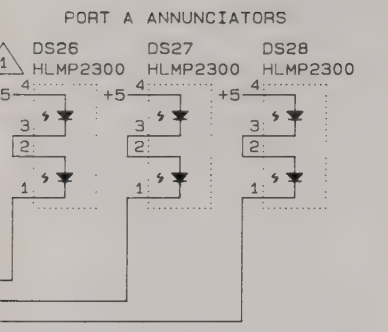


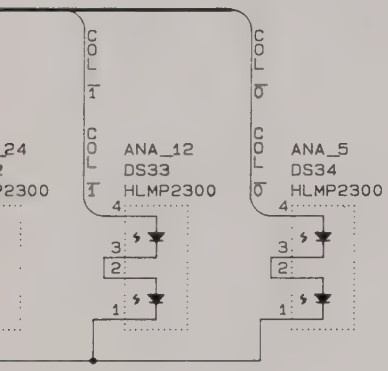
Figure 9-7.
Switch/LED Status PCB Assembly (A3)
Component Location, P/N 193-1300-000


PORT B ANNUNCIATORS
DS23 HLMP2300
DS24 HLMP2300
DS25 HLMP2300
+5
FRONT PANEL ANNUNCIATOTS
J1
ANB_TTL 8
ANB_SINK 7
ANB_SCE 6
ANA_TTL 5
ANA_SINK 4
ANA_SCE 3
+5V 2
1
+5
COL_0-COL_5
ANB_24 DS29 HLMP2300
ANB_12 DS30 HLMP2300
ANB_5 DS31 HLMP2300
ROW_3 16
COL_0 9
COL_1 10
COL_2 11
COL_3 12
COL_4 13
COL_5 14
STATUS ANNUNCIATORS
AN_PRGM_B DS17 HLMP2300
AN_PRGM_A DS18 HLMP2300
AN_ADRS DS19 HLMP2300
ROW_2 15



NOTES:

1. DS23 AND DS26 NOT INSTALLED.



REF DES	LAST USED	NOT USED
DS	DS34	DS1-DS16
J	J2	--
S	S18	--

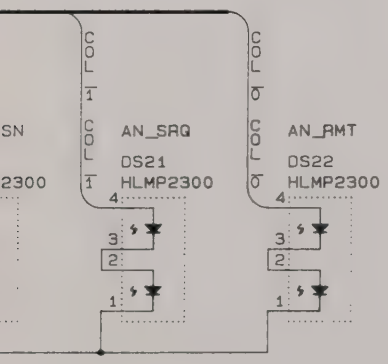
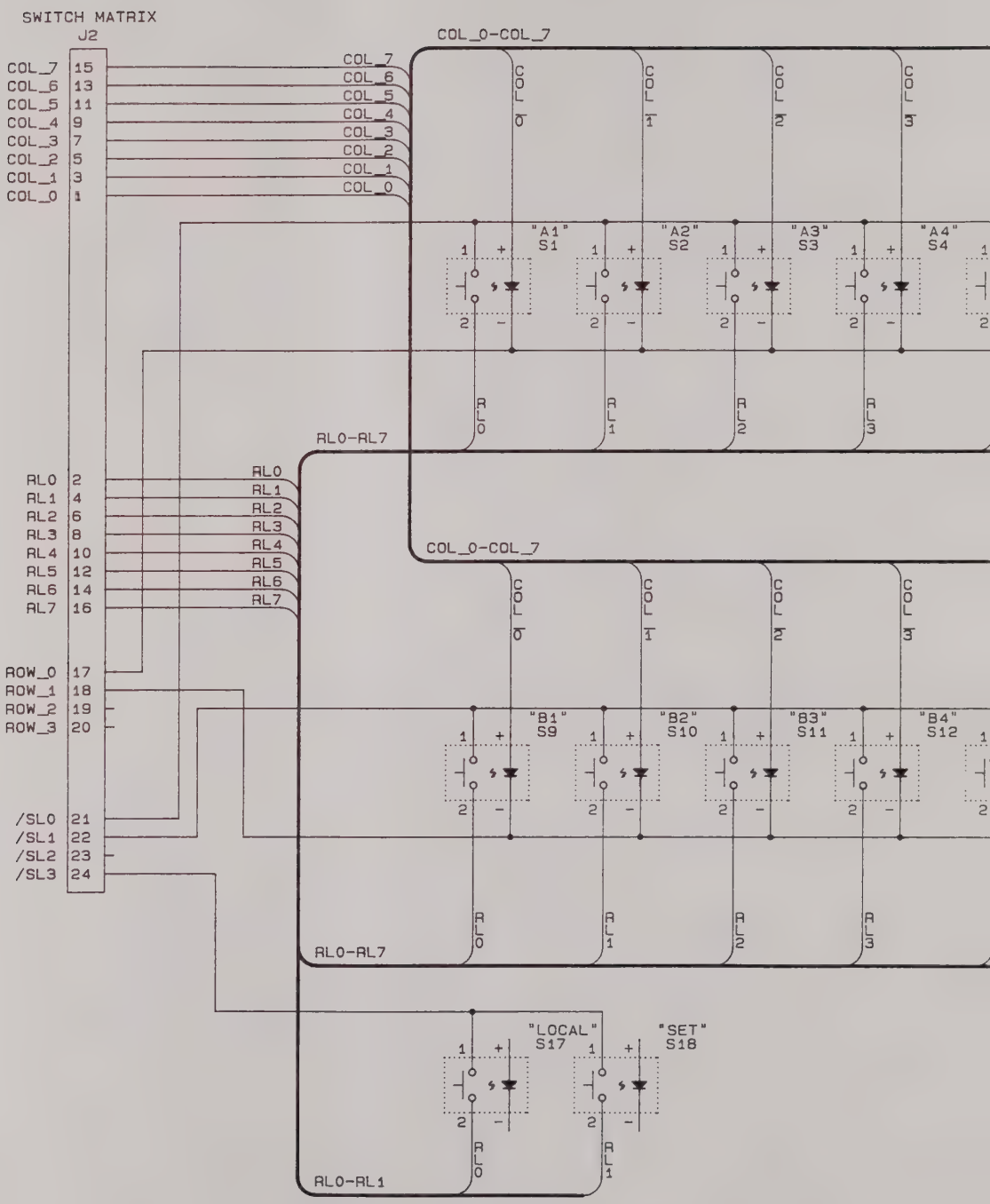


Figure 9-7.
Switch/LED Status PCB Assembly (A3) Schematic Diagram, P/N 193-1300-200 (Sheet 1 of 2)


SWITCH MATRIX
J2
COL_7 15
COL_6 13
COL_5 11
COL_4 9
COL_3 7
COL_2 5
COL_1 3
COL_0 1
RL0 2
RL1 4
RL2 6
RL3 8
RL4 10
RL5 12
RL6 14
RL7 16
ROW_0 17
ROW_1 18
ROW_2 19
ROW_3 20
/SL0 21
/SL1 22
/SL2 23
/SL3 24
COL_0-COL_7
RL0-RL7
"A1" S1
"A2" S2
"A3" S3
"A4" S4
"B1" S9
"B2" S10
"B3" S11
"B4" S12
"LOCAL" S17
"SET" S18
RL0-RL1

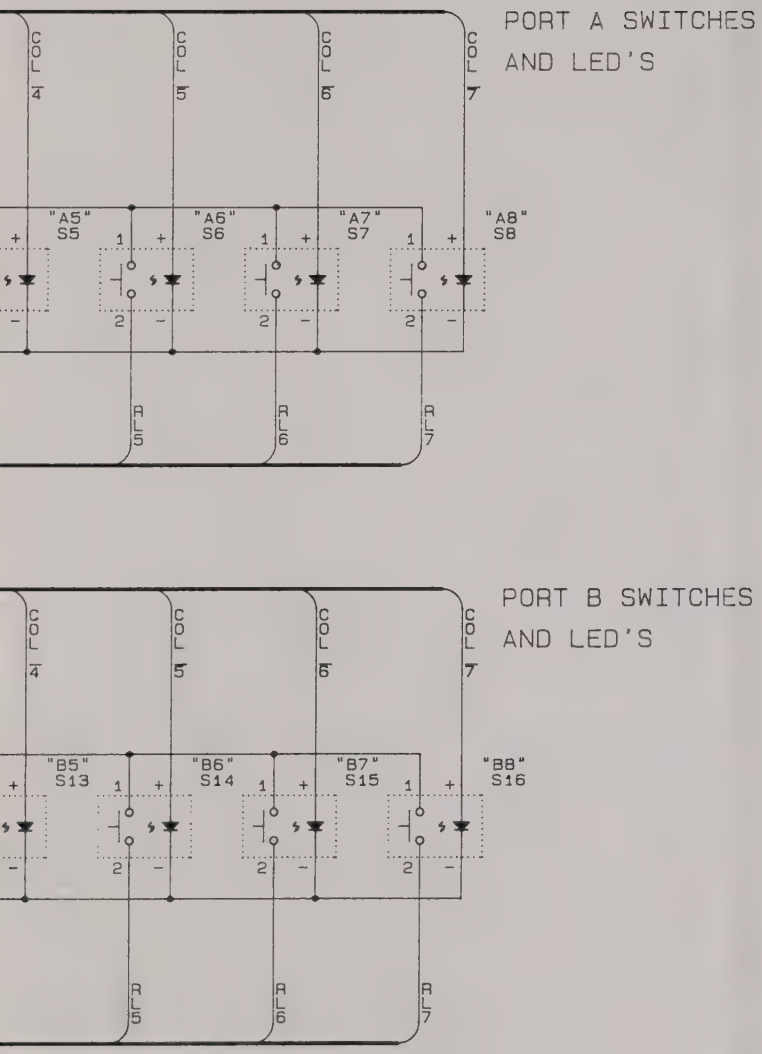
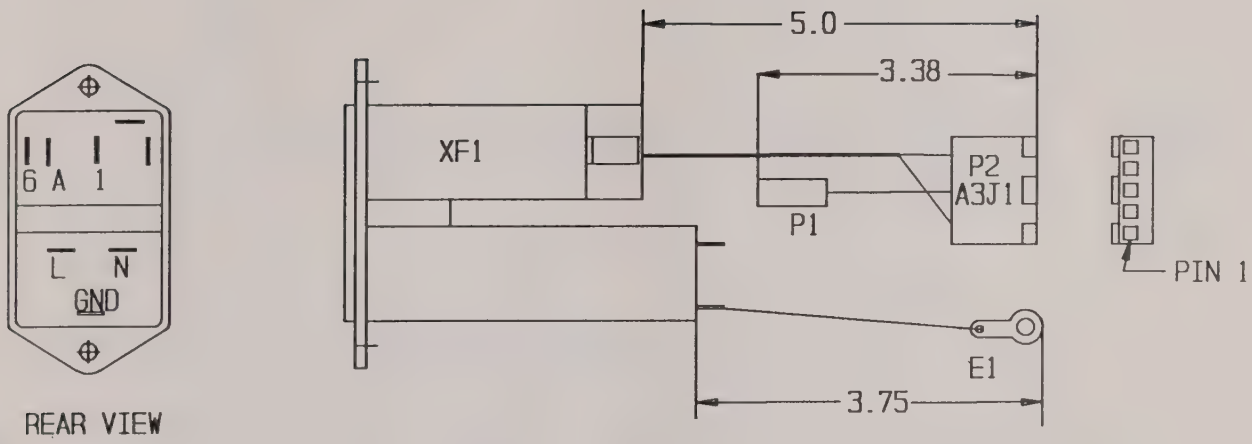


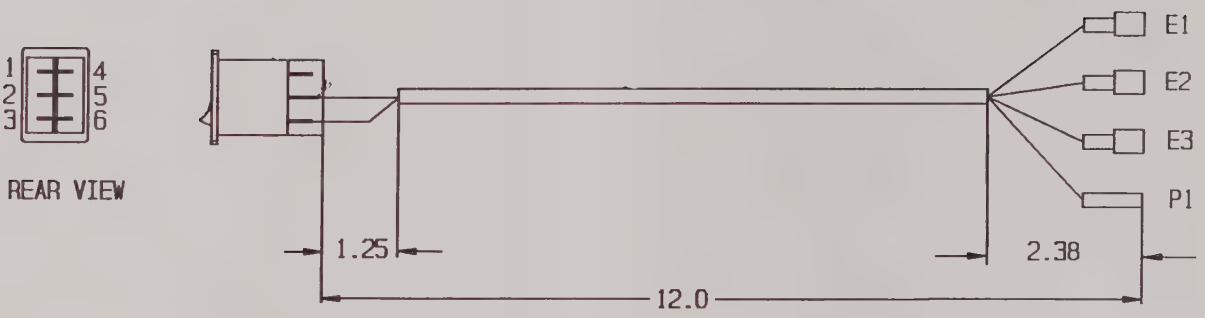
Figure 9-7.
Switch/LED Status PCB Assembly (A3) Schematic Diagram, P/N 193-1300-200 (Sheet 2 of 2)



WIRING CHART

FROM	TO	REMARKS
P1	P2-3	ITEM 12
XF1-1	P2-5	ITEM 13
XF1-6	P2-1	ITEM 14
XF1-GND	E1	ITEM 11

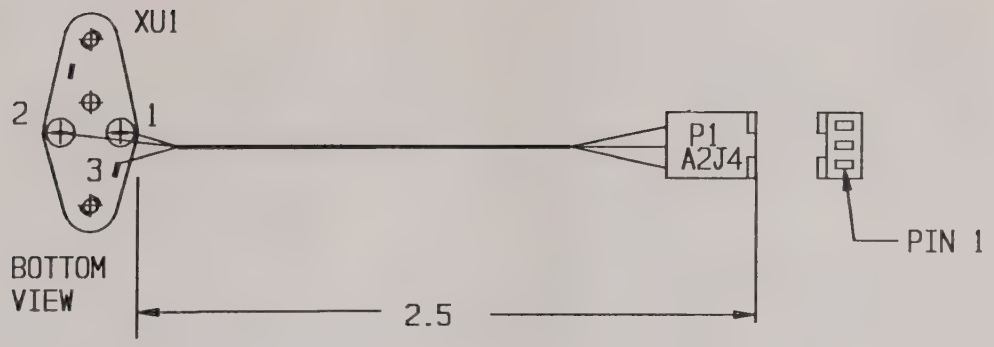
Figure 9-9.
Power Entry Module Assembly (F1 and XF1)
Component Location, P/N 193-1408



WIRING CHART

FROM	TO	COLOR	REMARKS
S1-1	NC		SLEEVE
S1-2	E2	BLACK	
S1-3	E3	GREEN	
S1-4	NC		SLEEVE
S1-5	E1	WHITE	
S1-6	P1	RED	

Figure 9-10.
Power Switch Assembly (S1)
Component Location, P/N 193-1409



WIRING CHART

FROM	TO	REMARKS	
XU1- 1	P1- 3	ITEM 8	TWISTED
XU1- 2	P1- 2	ITEM 7	
XU1- 3	P1- 1	ITEM 6	

Figure 9-11.
Regulator/Socket Assembly (U1 and XU1)
Component Location, P/N 193-1410

Notes:

SUPPLEMENT I
CONTROLLER MODIFICATIONS

S1-1. GENERAL.

This supplement outlines all the modifications made to the Model 8200 Controller design. Also included in this supplement are installation instructions for the Power Supply Retrofit Kit (P/N 193-1028) should the controller's power supply need to be replaced.

S1-2 CONTROLLER MODIFICATIONS.

The following paragraphs will describe all modifications that have been made to the Model 8200's design (Figure S1-1). While some Model 8200 Controllers may already contain these modifications, all models above serial number 163 will have them incorporated.

S1-2.1 POWER SUPPLY ASSEMBLY, A3. The original Model 8200s contained a Power Supply Assembly (P/N 001-296) which is now obsolete and can not be obtained through Lucas Weinschel Inc. If ordering a new assembly, this Power Supply Assembly (when defective only) will be replaced by Power Supply Assembly (P/N 001-304). The two Power Supply Assemblies are interchangeable and DO NOT affect the Model 8200 electrical specifications. The new Power Supply can be installed using paragraph S1-3. Figure S1-3 provides a new schematic illustrating these changes.

S1-2.2 DRIVER PCB ASSEMBLY, A2. Some controllers may contain an upgraded Driver PCB Assembly, A2 (P/N 193-1200-000 Rev F). Figure S1-2 and S1-3 provide a new component location and a schematic diagram for the upgraded Driver PCB Assembly.

S1-2.3 OUTPUT DRIVER SECTION. This paragraph replaces paragraph 5-2.5 if the upgraded Driver PCB Assembly is installed. The output driver section consists of a Driver PCB Assembly that serves to interface the CPU PCB Assembly with the high-current driver pins, device power-supply selectors, configuration switches, and input status pins. Refer to Figure S1-3 as an aid in understanding the following discussions.

This Driver PCB Assembly interfaces with the CPU Assembly via the J3 Expansion Bus connector. The CPU PCB Assembly provides the Driver PCB Assembly with address, data bus, and control signal information. The lower-order address information (AD7-AD0) is demultiplexed and latched by U27 74HC75, to form A7-A0, and then presented to U1 18CV8 PLD for selection of the various functions on the Driver PCB Assembly. PLD U1 serves to generate the output-enable, load, and clock signals required by the Driver PCB Assembly, as shown in Table S1-1.

The Driver PCB Assembly receives +5 V and +24 V from the Power Supply Assembly (A3). This Driver PCB Assembly contains circuitry to support a linear voltage regulator (an LM317 mounted on the chassis) that is used to derive a +12 Vdc supply from the +24 V input. The output voltage of the U30 programmable regulator is set by the ratio of resistors R20 and R21 according to the relationship Vout = Vref (1 + R21/R20), where V_{ref} = 1.25 V. This provides an output voltage from the regulator of approximately +12.8 volts. A voltage selector switch (SW1/SW2) provides for the ability to set the operating voltage of the drivers (VSS_A/VSS_B) to one of either the +5 V, +12 V, or +24 V supplies. The V_{SS} outputs of each selector switch are monitored by an Under/Over voltage detector (ICL7665 U3/U4) to provide the setting of each selector switch to the processor. The ICL7665 contains two individually programmable voltage detectors, that are set up as simple threshold detectors to provide a window comparator. The ICL7665 consists of two comparators which compare input voltages on the SET1 and SET2 terminals to an internal 1.3 V band-gap reference. The outputs from the two comparators drive open-drain N-channel transistors for Out1 and Out2.

Input Voltage	Out1	Out2
V_{SET1} (VSS)	OFF (high)	ON (low)
$V_{SET1\&2}$	ON (low)	ON (low)
V_{SET2} (V_{SS})	ON (low)	OFF (high)

The trip points for the detectors may be computed as follows:

Vtrip1 = 1.3 *(R2+R1)/R2 = 10.1 V
Vtrip2 = 1.3 *(R4+R3)/R4 = 20.4 V

Each driver port contains two 8-bit shift registers (74HC595) that contain the programming information for the true and complimentary drivers. The 74HC595 devices each contain an 8-bit serial-in, parallel-out shift register that feeds an 8-bit D-type storage register. Two 74HC595 devices are cascaded together to form a 16-bit shift register. Data from the least significant bit of the processor bus (AD0) is clocked into the shift register on the rising edge of the SRCK (SCLK_A/SCLK_B) signal when the processor performs an I/O write to the appropriate address (Refer to Table S1-1). Data from the shift registers is then transferred to the output storage register on the rising edge of the LOAD_A /LOAD_B signals under direction of the processor.

Table S1-1. Data Bus Control Signals

Signals							Description
/PCS	A3	A2	A1	A0	/RD	/WR	
1	X	X	X	X	X	X	Driver Card I/O not selected
0	0	0	0	0	0	1	/ENA_RD0 active (U2 output enable)
0	0	0	0	1	0	1	/ENA_RD1 active (U29 output enable)
0	0	0	0	0	1	0	SCLK_A active (Port A shift register clock)
0	0	0	0	1	1	0	SCLK_B active (Port B shift register clock)
0	0	1	X	1	1	0	LOAD_A active (Load Port A shift register)
0	0	1	1	X	1	0	LOAD_B active (Load Port B shift register)

The output data from the shift registers is used as inputs to the SN754410 quad half-H drivers, whose outputs are available at either internal or external connectors for control of devices. The SN754410 is a quadruple high-current half-H driver, designed to drive inductive loads such as relays, as well as other high-current/high-voltage loads. Each output from the SN754410 is a complete totem-pole driver with a Darlington transistor sink and a pseudo- Darlington source, providing bidirectional drive currents.

Each external port also contains an input connection to an HCPL2730 opto coupler that may be used to provide a status signal input to the processor. The HCPL-2730 is a dual-input low current high-gain optocoupler. The input pins (/IN_A and /IN_B) to the optocoupler are connected as LOW active inputs, and will interface with any device capable of sinking approximately 5 mA of current in the active state.

U2 74ACT541 serves as an input port, allowing the processor to read the setting of the configuration DIP switch SW3 when /ENA_RD0 is at an active LOW level. U29 74ACT541 provides an input port that allows the processor to read the two voltage selector detectors (VA1, VA2, VB1, and VB2), the input status pins (/IN_A and /IN_B), and two shift register loop back signals (SRA_TEST and SRB_TEST).

S1-3 POWER SUPPLY RETROFIT KIT (P/N 193-1028) INSTALLATION INSTRUCTIONS.

S1-3.1 KIT PARTS LIST. The following list contains all mechanical parts and electrical components that will be used in the installation of the new Power Supply Assembly (P/N 001-304). Inventory all items received with your installation Kit against those parts or components listed.

Part No.	Nomenclature	QTY
001-304	Power Supply Unit, Switching 40 W UNIV Input Voltage	1
062-327-2	Connector Housing 3 Pin 0.156 Centers	1
062-343	Connector, Self-Sriping	1

S1-3.2 KIT INSTALLATION. The following procedure and Figure S2-1 provides general installation instructions to be used as an aid in when installing the Power Supply Retrofit Kit (P/N 193-1028).

a. Remove old Power Supply Assembly (A3) using Table 5-2 (If not previously removed).

b. Remove existing Power Entry Module connector, XF1P2 (P/N 062-327).

c. Wire new connector using Figure S1-6.

d. Using Figure S2-1, position the new Power Supply Assembly (P/N 001-304) into the Model 8200 and secure using screws previously removed.

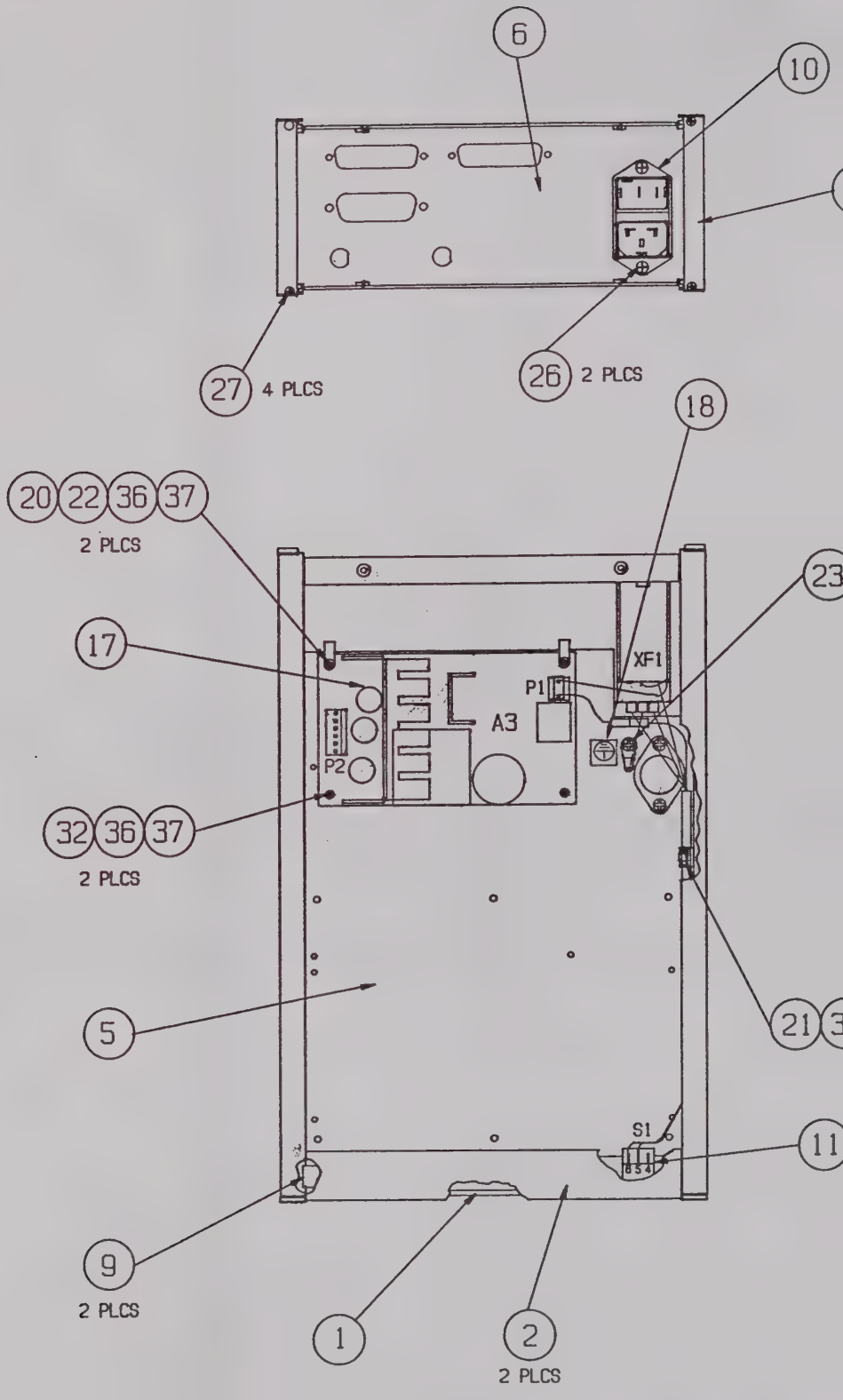
e. Connect cables to the Power Supply Assembly as shown in Figure 9-2.

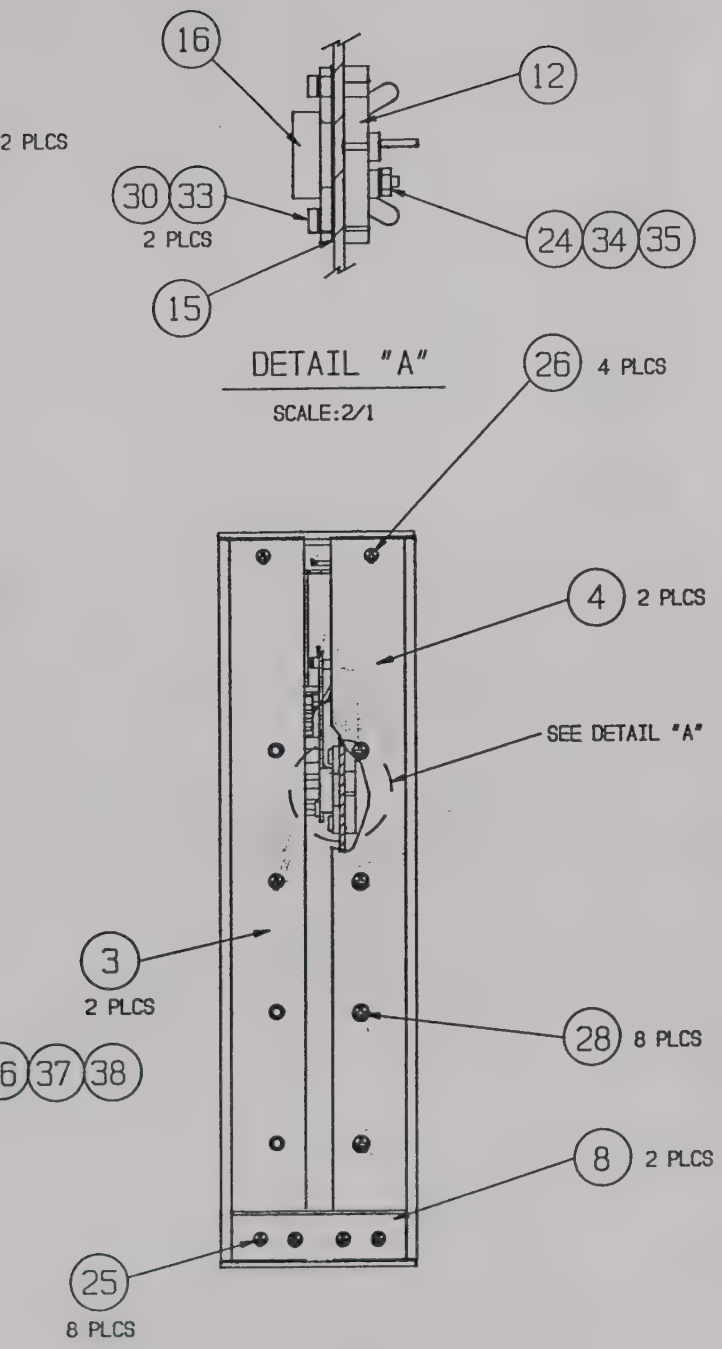
f. Carefully slide bottom cover into Model 8200 and secure using screws previously removed.

g. Perform all the Performance Test and Verification procedures (located in Section VII) to ensure proper operation of the 8200.

S1-4 ADDITIONAL/REPLACEMENT PARTS.

Table S1-2 thru S1-5 list all components and hardware added to the Model 8200. Table S1-3 lists the components located on the new Driver PCB Assembly, A2.

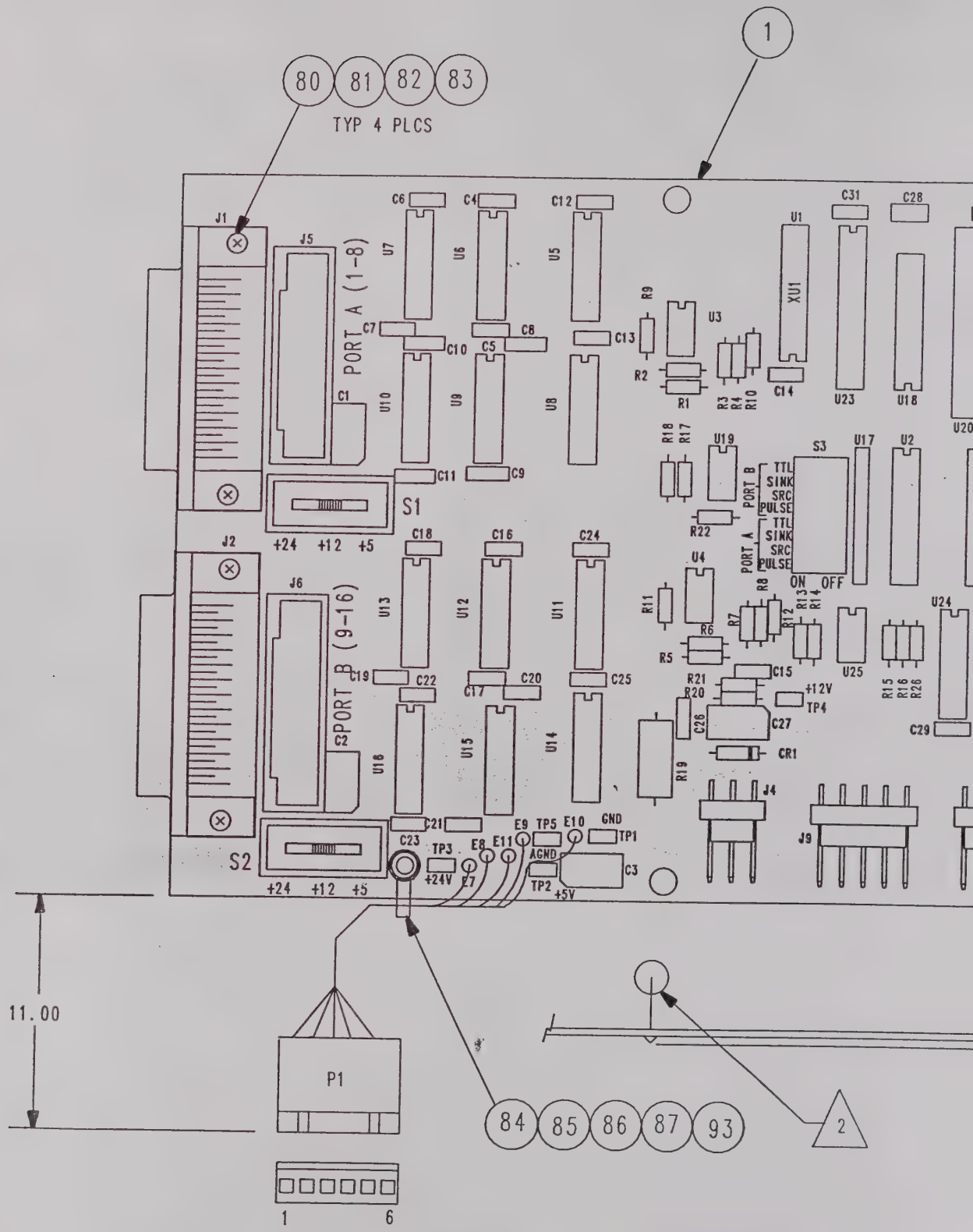

6
10
27 4 PLCS
26 2 PLCS
18
20 22 36 37
2 PLCS
23
17
XF1
P1
A3
P2
32 36 37
2 PLCS
5
21
S1
11
9
2 PLCS
1
2
2 PLCS

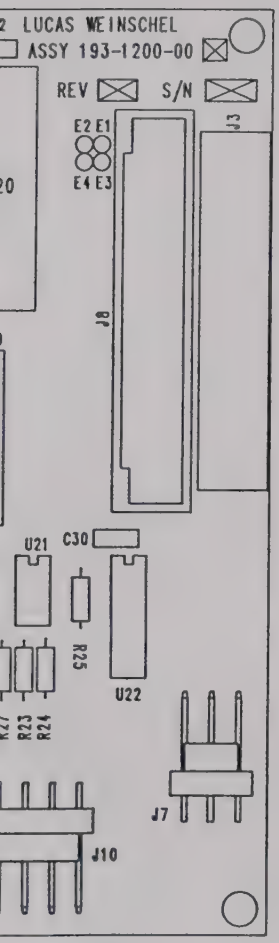


WIRE CHART

FROM	TO	COLOR
XF1-P2	A3-P1	——
XF1-P1	S1-P1	RED
XF1-E1	CHASSIS	GRN/YEL
S1-E1	XF1-N	WHT
S1-E2	XF1-L	BLK
S1-E3	XF1-A	GRN

Figure S1-1.
Assembly, Cabinet Component Location,
P/N 193-1400


80
81
82
83
TYP 4 PLCS
1
J1
J5
PORT A (1-8)
J2
J6
PORT B (9-16)
S1
S2
+24
+12
+5
S3
PORT B
PORT A
TTL
SINK
SRC
PULSE
ON
OFF
XU1
+12V
TP4
CR1
J4
J9
TP1
TP2
TP3
TP5
GND
AGND
+24V
+5V
11.00
P1
1
6
84
85
86
87
93
2



NOTES:

1. THE FOLLOWING COMPONENTS ARE NOT INSTALLED:
   C31, J1, J2, J9, J10, R23, R24, R25, U21, U22
2. POSITION R19 APPROX. 1 BODY DIA. OFF BOARD.
3. FOR PARTS LIST REFER TO TABLE 8-3.

WIRING CHART			
FROM	TO	REMARKS	
P1-6	N/C		
P1-5	E10	USE ITEM 90 & 29	BLK
P1-4	E9	USE ITEM 90 & 29	BLK
P1-3	E8	USE ITEM 91 & 29	RED
P1-2	E11	USE ITEM 91 & 29	RED
P1-1	E7	USE ITEM 92 & 29 — ORN/WHT	

TWISTED

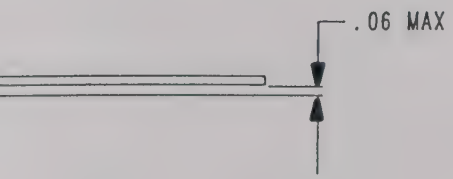
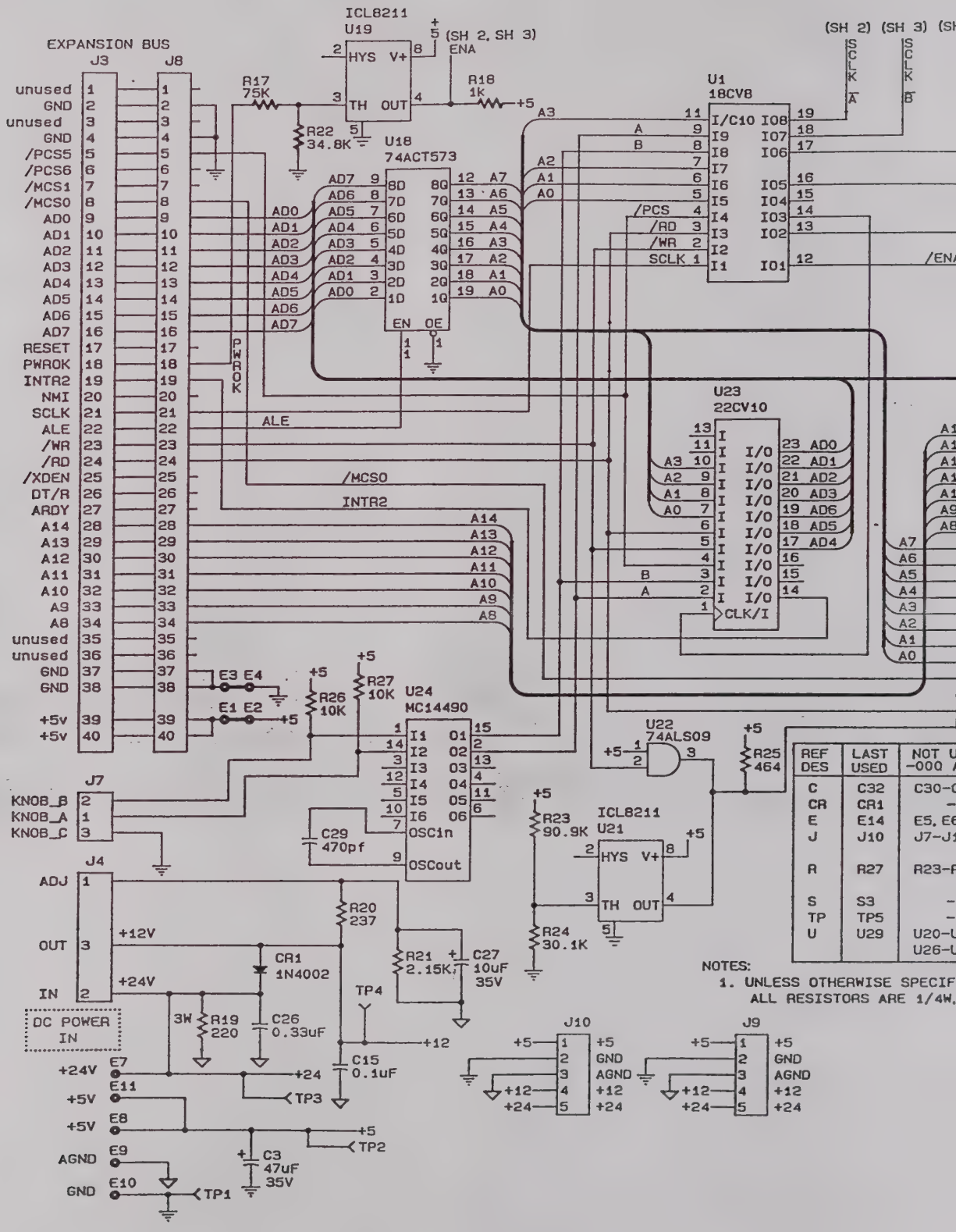
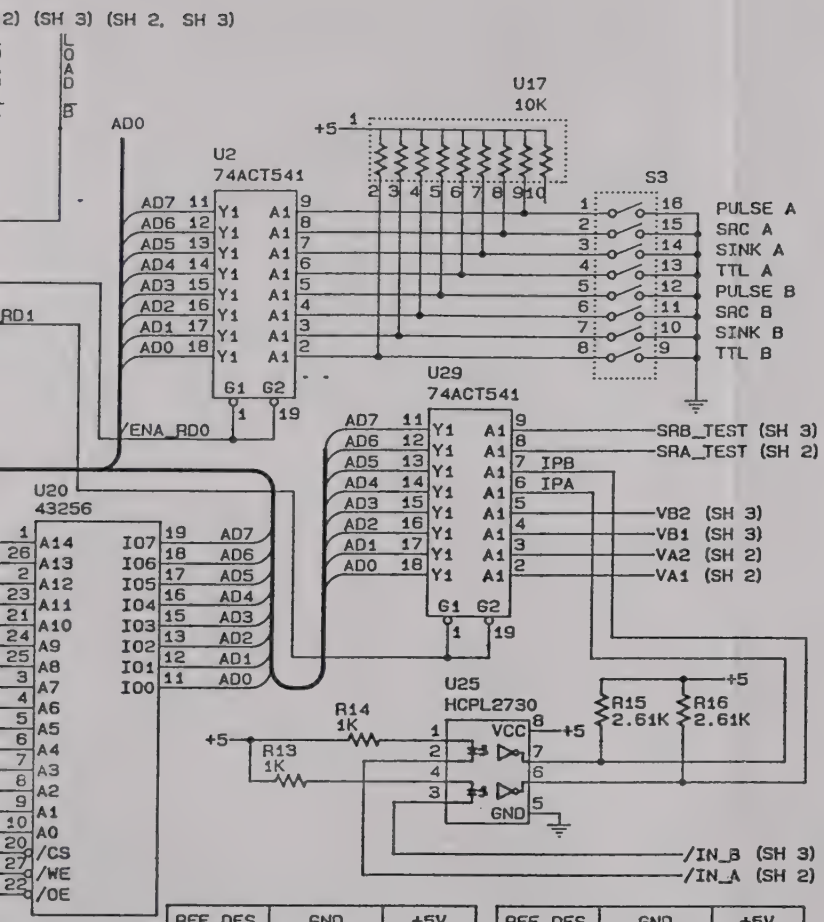


Figure S1-2
Driver PCB Assembly (A2) Component Location,
P/N 193-1200-000 REV. F


EXPANSION BUS
J3
J8
ICL8211
U19
(SH 2, SH 3)
ENA
R17
75K
R18
1k
R22
34.8K
U18
74ACT573
U1
18CV8
U23
22CV10
ALE
/MCS0
INTR2
PWROK
U24
MC14490
U22
74ALS09
R25
464
R27
10K
R26
10K
J7
KNOB_B
KNOB_A
KNOB_C
C29
470pf
OSCin
OSCout
J4
ADJ
OUT
IN
+12V
+24V
DC POWER IN
R20
237
R21
2.15K
C27
10uF
35V
CR1
1N4002
R19
220
C26
0.33uF
C15
0.1uF
C3
47uF
35V
TP1
TP2
TP3
TP4
R23
90.9K
R24
30.1K
ICL8211
U21
J10
J9
REF DES
LAST USED
NOTES:
1. UNLESS OTHERWISE SPECIF
ALL RESISTORS ARE 1/4W,

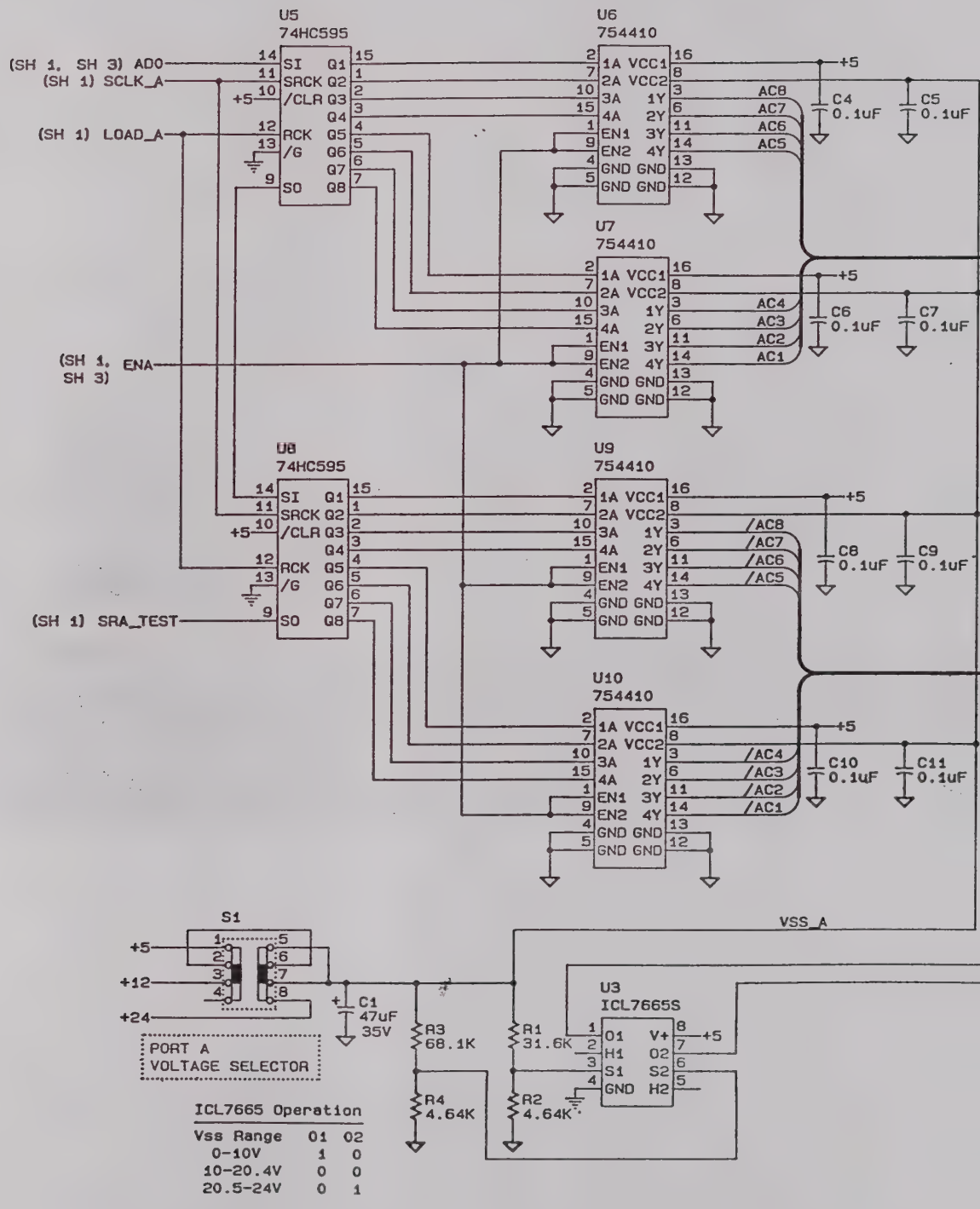


REF DES	GND	+5V	
U1	10	20	C14
U2	10	20	
U3	–	–	
U4	–	–	
U5	8	16	C12
U6	–	–	
U7	–	–	
U8	8	16	C13
U9	–	–	
U10	–	–	
U11	8	16	C24
U12	–	–	
U13	–	–	
U14	8	16	C25
U15	–	–	

REF DES	GND	+5V	
U16	–	–	
U17	–	–	
U18	10	20	C28
U19	–	–	
U20	14	28	C32
U21	NOT USED		
U22	7	14	C30
U23	10	20	C31
U24	8	16	C29
U25	–	–	
U26	NOT USED		
U27	NOT USED		
U28	NOT USED		
U29	10	20	

NOT USED -001 ASSY	
C31	
J1, J2, J9, J10	
R23, R24 R25	
U21, U22	
U26–U28	

Figure S1-3.
Driver PCB Assembly (A2) Schematic Diagram, P/N 193-1200-200 (Sheet 1 of 3)


U5
74HC595
U6
754410
U7
754410
U8
74HC595
U9
754410
U10
754410
(SH 1, SH 3) ADO
(SH 1) SCLK_A
(SH 1) LOAD_A
(SH 1, SH 3) ENA
(SH 1) SRA_TEST
SI
SRCK
/CLR
RCK
/G
SO
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
1A VCC1
2A VCC2
3A 1Y
4A 2Y
EN1 3Y
EN2 4Y
GND GND
+5
AC8
AC7
AC6
AC5
AC4
AC3
AC2
AC1
/AC8
/AC7
/AC6
/AC5
/AC4
/AC3
/AC2
/AC1
C4 0.1uF
C5 0.1uF
C6 0.1uF
C7 0.1uF
C8 0.1uF
C9 0.1uF
C10 0.1uF
C11 0.1uF
S1
+5
+12
+24
PORT A
VOLTAGE SELECTOR
C1
47uF
35V
R3
68.1K
R4
4.64K
R1
31.6K
R2
4.64K
U3
ICL7665S
O1
H1
S1
GND
V+
O2
S2
H2
VSS_A
ICL7665 Operation
Vss Range O1 O2
0-10V 1 0
10-20.4V 0 0
20.5-24V 0 1

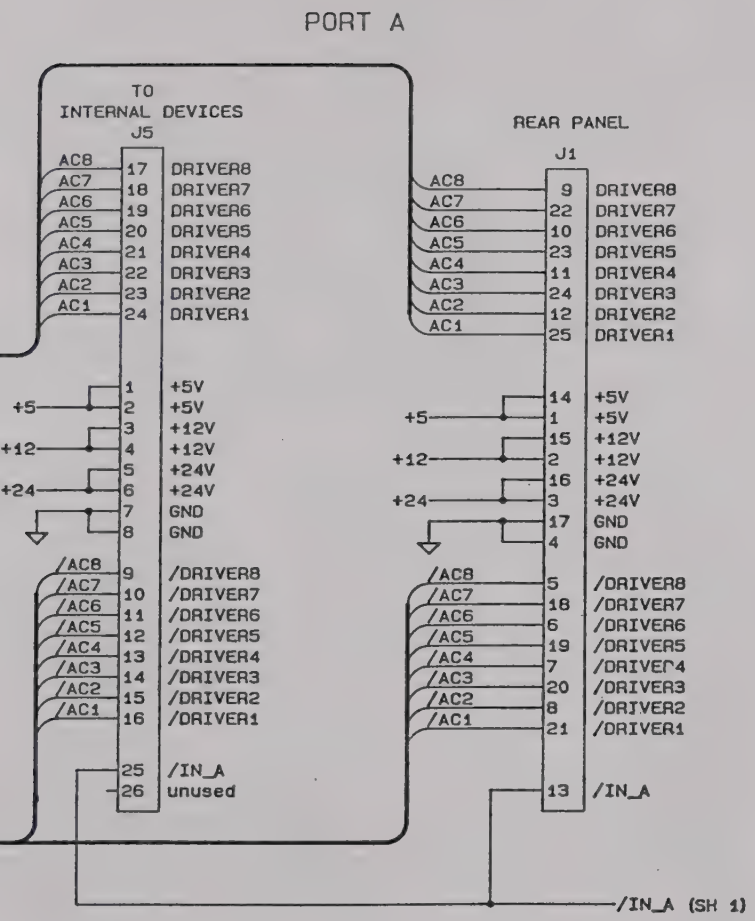
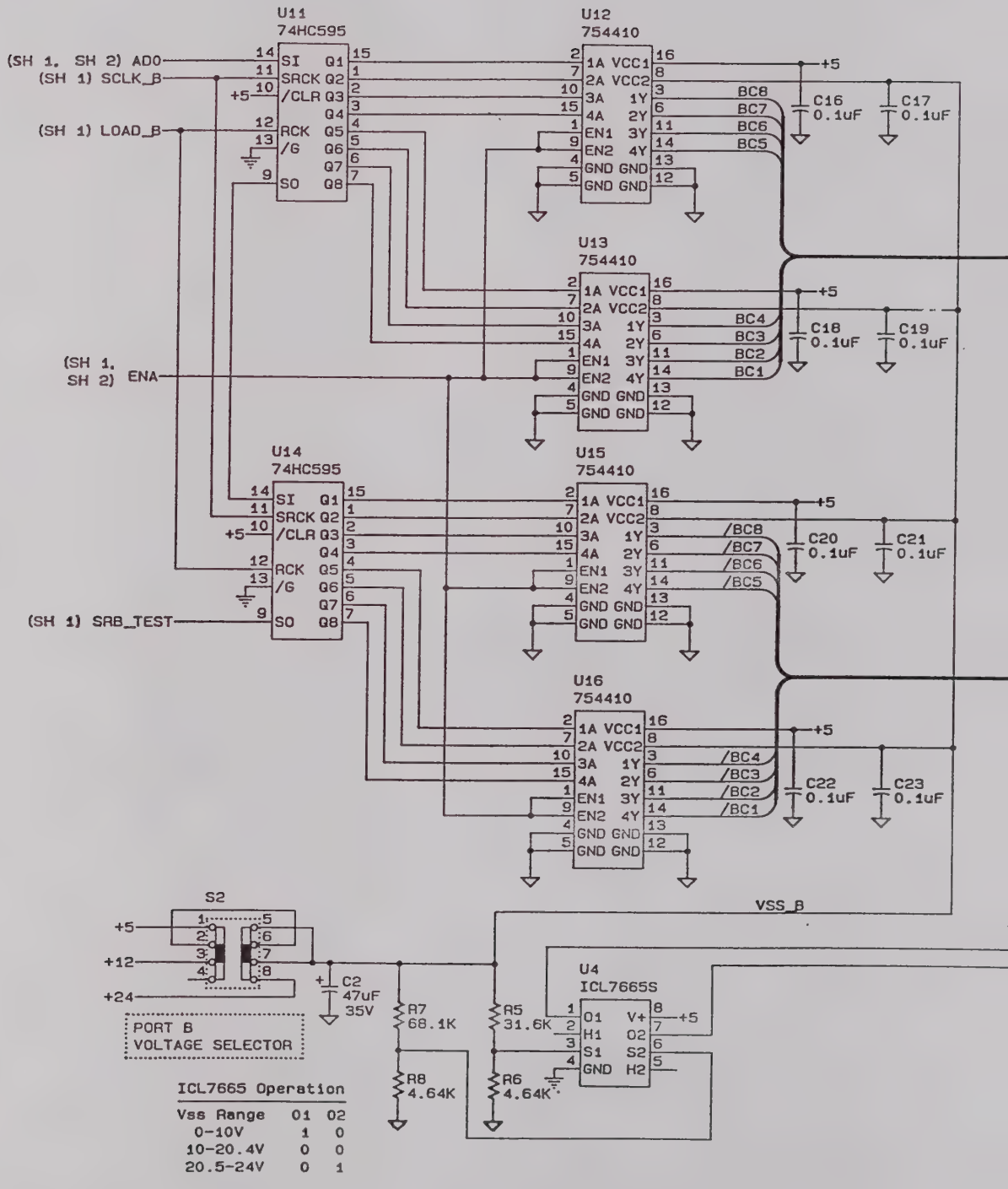


Figure S1-3.
Driver PCB Assembly (A2) Schematic Diagram,
P/N 193-1200-200 (Sheet 2 of 3)


U11
74HC595
U12
754410
U13
754410
U14
74HC595
U15
754410
U16
754410
(SH 1, SH 2) ADO
(SH 1) SCLK_B
(SH 1) LOAD_B
(SH 1, SH 2) ENA
(SH 1) SRB_TEST
+5
BC8
BC7
BC6
BC5
BC4
BC3
BC2
BC1
/BC8
/BC7
/BC6
/BC5
/BC4
/BC3
/BC2
/BC1
C16 0.1uF
C17 0.1uF
C18 0.1uF
C19 0.1uF
C20 0.1uF
C21 0.1uF
C22 0.1uF
C23 0.1uF
S2
+12
+24
VSS_B
C2 47uF 35V
R7 68.1K
R8 4.64K
R5 31.6K
R6 4.64K
U4
ICL7665S
PORT B VOLTAGE SELECTOR
ICL7665 Operation
Vss Range 01 02
0-10V 1 0
10-20.4V 0 0
20.5-24V 0 1

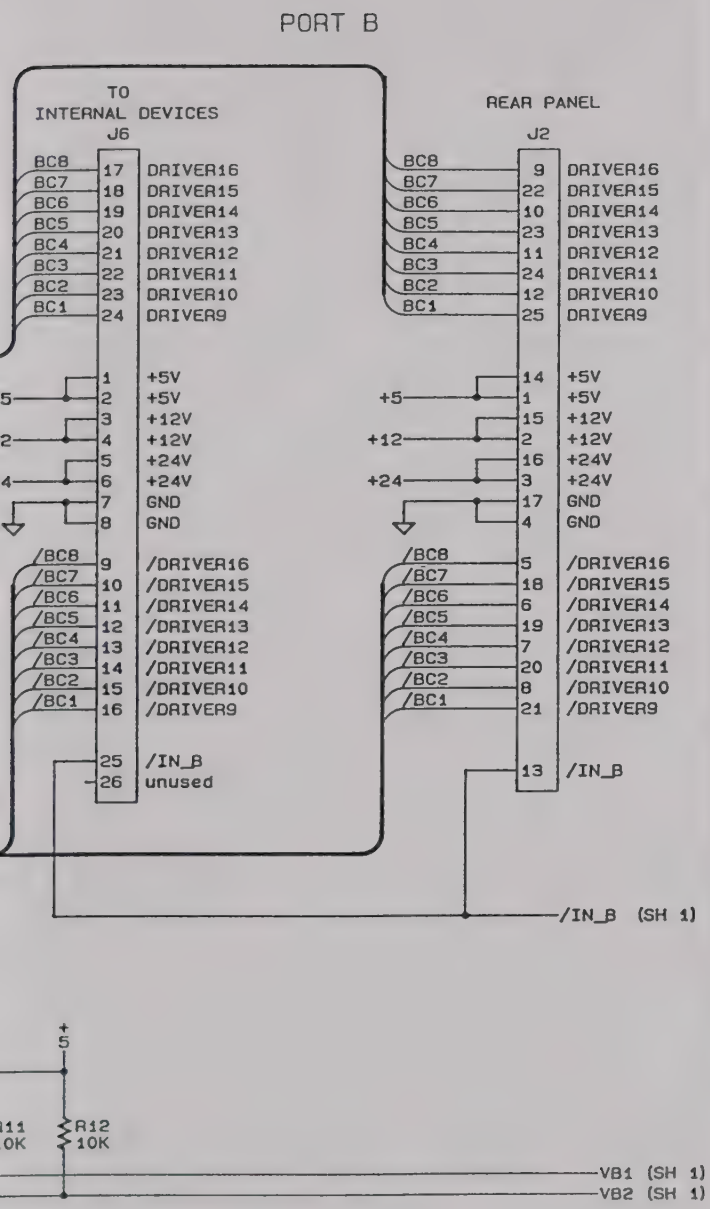
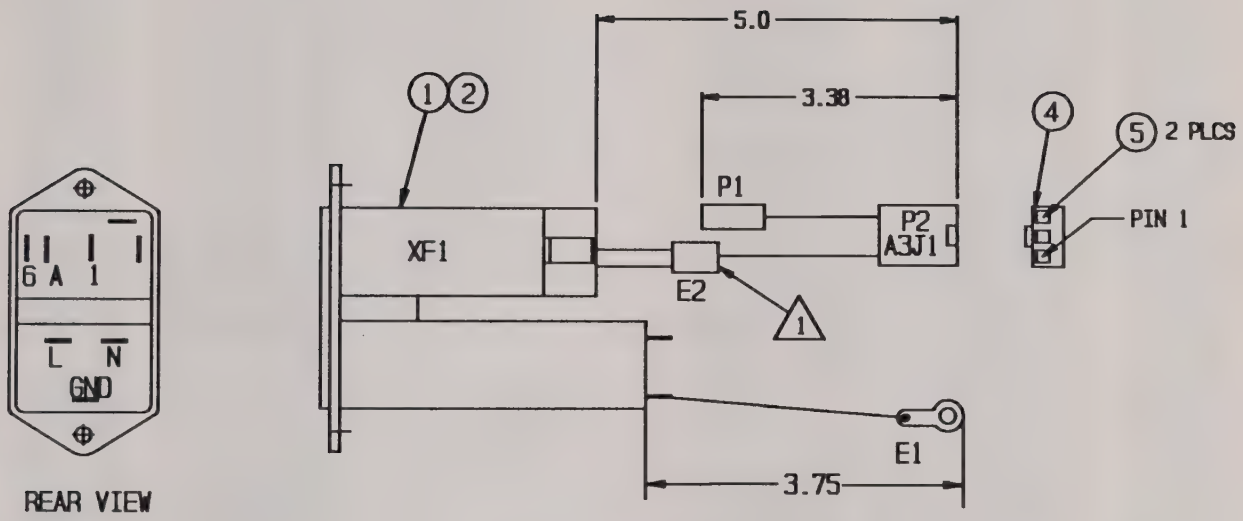


Figure S1-3.
Driver PCB Assembly (A2) Schematic Diagram,
P/N 193-1200-200 (Sheet 3 of 3)



WIRING CHART			
FROM	TO	REMARKS	
P1	P2-3	ITEM 12	
XF1-1	E2	ITEM 13	1
XF1-6	P2-1	ITEM 13	
XF1-GND	E1	ITEM 11	

1 CONNECT WIRE FROM XF1-1 TO WIRE BETWEEN XF1-6 AND P2-1 USING ITEM 7.(P/N 062-343)

Figure S1-4.
Power Entry Module Assembly (F1 and XF1)
Component Location, P/N 193-1408

Table S1-2. ASSY, Cabinet (P/N 193-1400)

FIND NO.	REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE
1	NA	ASSY, FRONT PANEL/ OVERLAY	193-1100		93459
2	NA	BEZEL	193-1401		93459
3	NA	FRAME	193-1402-1		93459
4	NA	FRAME	193-1402-2		93459
5	NA	CHASSIS	193-1403		93459
6	NA	REAR PANEL	193-1404		93459
7	NA	REAR TRIM	193-1405		93459
8	NA	FRONT TRIM	193-1406		93459
9	NA	BEZEL RETAINER	193-1407		93459
10	NA	ASSY, PWR ENTRY MODULE	193-1408		93459
11	NA	ASSY, PWR SWITCH	193-1409		93459
12	NA	ASSY ,REG/SOCKET	193-1410		93459
15	NA	INSULATOR ELASTOMER TO-3	012-29-48	60-11-4302-1674	18565
16	U1	IC ,VOLTAGE REGULATOR	015-07-LM317K	LM317K	12040
17	A3	POWER SUPPLY UNIT, SWITCHING 40W, UNIV INPUT VOLT	001-304	FLU2-40-3AD	62506
18	NA	LABEL GROUND	090-353		93459
20	NA	CABLE TIE	074-170-4	TY-34M	56501
21	NA	CLAMP CABLE 3/16 DIA	074-749	8941	08330
22	NA	SCREW, PAN HD 6-32 X 5/8 LG		MS51957-31	96906
23	NA	SCREW, PAN HD 4-40 X 3/16 LG		MS51957-12	96906
24	NA	SCREW, FLAT HD 4-40 X 5/8 LG 100		MS24693-C7	96906
25	NA	SCREW, FLAT HD 4-40 X 3/8 LG 100		MS24693-C4	96906
26	NA	SCREW, FLAT HD 4-40 X 5/16 LG 100		MS24693-C3	96906
27	NA	SCREW, FLAT HD 2-56 X 5/16 LG 100		NAS662C2R5	80205
28	NA	SCREW, FLAT HD 6-32 X 5/16 LG 100		MS24693-C25	96906
30	NA	SCREW, PAN HD 6-32 X 9/16 LG		MS51957-123	96906
31	NA	SCREW, FLAT HD 6-32 X 7/16 LG 100		MS24693-C27	96906
32	NA	SCREW, PAN HD 6-32 X 1/2 LG		MS51957-30	96906
33	NA	WASHER, LOCK #6 EXTERNAL TOOTH		MS35335-58	96906
34	NA	WASHER, LOCK #4		MS35338-135	96906
35	NA	NUT HEX #4		MS35649-244	96906
36	NA	WASHER, FLAT .156 ID .312 OD		MS15795-805	96906
37	NA	WASHER ,LOCK #6		MS35338-136	96906
38	NA	NUT, HEX #6		MS35649-264	96906

* Refer to Figure S1-1 for component location.

Table S1-3. ASSY, PCB, Driver, A2 (P/N 193-1200-000)

FIND NO.	REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE
1	NA	FAB PCB DRIVER BD	193-1200-100		93459
2	NA	SCHEMATIC DIAGRAM	193-1200-200		93459
9	C1	CAP, TANT 47uF 10% 35V	031-112-476	T368D476K035AS	05397
	C2	CAP, TANT 47uF 10% 35V	031-112-476	T368D476K035AS	05397
	C3	CAP, TANT 47uF 10% 35V	031-112-476	T368D476K035AS	05397
10	C4	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C5	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C6	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C7	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C8	CAP ,CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C9	CAP ,CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C10	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C11	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C16	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C17	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C18	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C19	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C20	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C21	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C22	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C23	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
	C15	CAP, CER .1uF 50V 10%	034-27-104	CK05BX104K	56289
11	C12	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
	C13	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
	C24	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
	C25	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
	C28	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
	C14	CAP, CER .01uF 100V 10%	034-27-103	CK05BX103K	56289
12	C26	CAP, CER .33uF 10% 50V	034-28-334	CK06BX334K	56289
13	C27	CAP, TANT 10uF 10% 35V	031-112-106	T368C106K035AS	05397
20	CR1	DIODE RECTIFIER 100V	012-293	1N4002	04713
28	NA	CONN HOUSING, PCB MOD W/LOCKING RAMP 6 CIRCUITS	062-276	09-50-3061	27264
29	NA	CONTACT, CRIMP 18-24 AWG TIN PLATING LOOSE	062-327-1	08-50-0106	27264
30	J1	CONN, SUBMIN D RT ANGLE 25 CONTACT FLG MT HOLES W/THD INSR	062-340	EDBL25SBA1	71468
	J2	CONN, SUBMIN D RT ANGLE 25 CONTACT FLG MT HOLES W/THD INSR	062-340	EDBL25SBA1	71468
31	J3	CONN, DBL ROW RECEPT ASSY .100 CTRS 40 PIN	062-199-40	1-85930-4	00779
32	J4	CONN, HEADER, 3 PIN .156 CENTERS	062-327-3	26-48-1036	27264
33	J5	CONN HEADER, 26 PINS	062-204-26	1-103169-1	00779

Table S1-3. ASSY, PCB, Driver, A2 (P/N 193-1200-000)

FIND NO.	REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE
34	J6	CONN HEADER, 26 PINS	062-204-26	1-103169-1	00779
40	R1	RES, METALFILM 31.6K 1% 1/4W	025-33-3162	CCF55-3162F	91637
	R5	RES, METALFILM 31.6K 1% 1/4W	025-33-3162	CCF55-3162F	91637
41	R2	RES, METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637
	R4	RES, METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637
41	R6	RES, METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637
	R8	RES, METALFILM 4.64K 1% 1/4W	025-33-4641	CCF55-4641F	91637
42	R3	RES, METALFILM 68.1K 1% 1/4W	025-33-6812	CCF55-6812F	91637
	R7	RES, METALFILM 68.1K 1% 1/4W	025-33-6812	CCF55-6812F	91637
43	R9	RES, METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637
	R10	RE,S METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637
	R11	RES, METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637
	R12	RES, METALFILM 10K 1% 1/4W	025-33-1002	CCF55-1002F	91637
44	R13	RES, METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637
	R14	RES, METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637
	R18	RES, METALFILM 1K 1% 1/4W	025-33-1001	CCF55-1001F	91637
45	R15	RES, METALFILM 2.61K 1% 1/4W	025-33-2611	CCF55-2611F	91637
	R16	RES, METALFILM 2.61K 1% 1/4W	025-33-2611	CCF55-2611F	91637
46	R19	RES, WW 220 5% 3W	026-79-220	23J220	44655
47	R20	RES, METALFILM 237 1% 1/4W	025-33-2370	CCF55-2370F	91637
48	R21	RES, METALFILM 2.15K 1% 1/4W	025-33-2151	CCF55-2151F	91637
49	R17	RES, METALFILM 75K 1% 1/4W	025-33-7502	CCF55-7502F	91637
50	R22	RES, METALFILM 34.8K 1% 1/4W	025-33-3482	CCF55-3482F	91637
55	S1	SWITCH, PC MT SLIDE DP3T	055-104	C5631L2	82389
	S2	SWITCH ,PC MT SLIDE DP3T	055-104	C5631L2	82389
56	S3	SWITCH, PACKAGE 8 POS 7000 SERIES SPST DUAL IN LINE	055-59	435166-5	00779
60	TP1	TEST POINT	074-820	TP-101-10	26364
	TP2	TEST POINT	074-820	TP-101-10	26364
	TP3	TEST POINT	074-820	TP-101-10	26364
	TP4	TEST POINT	074-820	TP-101-10	26364
	TP5	TEST POINT	074-820	TP-101-10	26364
65	U1	IC, PAL	193-1201		93459
66	U2	IC, OCTAL BUS DRIVER	015-74ACT541	V74ACT541P	9Z527
	U29	IC, OCTAL BUS DRIVER	015-74ACT541	V74ACT541P	9Z527
67	U3	IC, U/O VOLTAGE DETECTOR	015-7665	ICL7665CPA	32293
	U4	IC, U/O VOLTAGE DETECTOR	015-7665	ICL7665CPA	32293
68	U5	IC, 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	01295
	U8	IC, 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	01295
	U11	IC, 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	01295
	U14	IC, 8 BIT SHIFT W/REG TS OU	015-74HC595	SN74HC595N	01295
69	U6	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U7	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295

Table S1-3. ASSY, PCB, Driver, A2 (P/N 193-1200-000)

FIND NO.	REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE
69	U9	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U10	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U12	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U13	IC, QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U15	IC ,QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
	U16	IC ,QUAD HALF-H DRIVER	015-754410	SN754410-NE	01295
70	U17	RES NETWORK, COMMON 10 PIN SIP 10K 2%	028-09-103	4310R-1001-103	80294
71	U18	IC, OCTAL TRANSPARENT LATCH D TYPE TRI STATE CMOS	015-74ACT573	V74ACT573P	9Z527
72	U25	IC, OPTO COUPLER DUAL LOW INPUT CURRENT HI GAIN	015-2730	HCPL2730	28480
73	U19	IC, VOLTAGE REFERENCE	015-8211	ICL8211CPA	32293
75	XU1	SOCKET, 20 PIN CONTACT DIP	061-85-20	520-AG19D	91506
80	NA	SCREW, PAN HD 4-40 X 5/16 LG		MS51957-14	96906
81	NA	NUT, HEX #4 CRES SMALL PATTERN		NAS671C4	80205
82	NA	WASHER, FLAT #4 SS		NAS620C4	80205
83	NA	WASHER, LOCK #4		NAS1676C4	80205
84	NA	SCREW, PAN HD 4-40 X 3/8 LG		MS51957-15	96906
85	NA	WASHER, FLAT #4		MS51859-2	96906
86	NA	NUT, HEX #4		MS51858-2	96906
87	NA	CABLE TIE	074-170-5	TY-33M	56501
90	NA	WIRE ,#22 BLACK TEFLON	079-147-10		93459
91	NA	WIRE, #22 RED TEFLON	079-147-2		93459
92	NA	WIRE, #22 WHT/ORN TEFLON	079-147-17		93459
93	NA	LOCTITE 242,(BLUE) REMOVABLE THREADLOCK MEDIUM STRENGTH		COML-55	NONE
96	NA	GROUND LUG #632	074-627-2	1416-6	83330

* Refer to Figure S1-2 for component location.
* Componets not installed on this assembly: C30 - C32, J7, J9, J10, R23 - R27, U20 - U24

Figure S1-4. ASSY, Power Entry Module, F1 & XF1 (193-1408)

FIND NO.	REF DES	DESCRIPTION	LUCAS PART NO.	MFG. PART NO.	CAGE
1	XF1	PWR ENTRY MODULE	051-38	3EDSC2-2	05245
2	NA	FUSE, DRAWER 1/4 X 11/4 FUSE	051-38-1	SC2N	05245
4	P2	CONN, HOUSING 3 PIN .156 CENTERS	062-327-2	09-50-3031	27264
5	NA	CONTACT, CRIMP 18-24 AWG TIN PLATING LOOSE	062-327-1	08-50-0106	27264
6	P1	TERMINAL RECEPTACLE, BULLET INSULATED 22-16 AWG	074-854-1	CVDGF2216T-5	28959
8	E1	GROUND LUG #4-40	074-627-3	1416-4	83330
11	NA	WIRE, #18 GRN/YEL PVC INSULATED	079-164-1		93459
12	NA	WIRE, #18 AWG 600V TEFLON .048 DIA RED	079-145-2		93459
13	NA	WIRE, #18 AWG 600V TEFLON .048 DIA BRN	079-145-1		93459

- Refer to Figure S1-4 for component location.

APPENDIX A
CARE AND HANDLING OF MICROWAVE COAXIAL CABLE ASSEMBLIES

A-1. CARE AND HANDLING OF ASSEMBLIES

To ensure accurate measurements and optimal performance of Weinschel Engineering products, the microwave coaxial cable assemblies used in system and test setups must be properly used and maintained. Proper connections, routine inspection of all cables, and cleaning of the connectors are extremely important procedures which can prolong the longevity and accuracy of equipment.

A-2. CABLE INSPECTION

Routinely check external cables for signs of cracked insulation, dents, twists, flattening, signs of jacket abrasion, or other signs of abuse. Wrinkles in the jacket indicate that the minimum bend radius has been exceeded. Most often, this occurs near the marker tubes and connectors.

Also inspect the connector interfaces for the following:

- Bent pins (male)
- Bent or missing tines (female)
- Worn or chipped plating
- Damaged or displaced dielectric inserts
- Thread damage
- Folded or mushroomed outer interface rims
- Mushroomed pin shoulders (male) or tine ends (female)
- Score lines on pins and outer interface rims visible to the unaided eye
- Recessed or protruding pins

It is advisable to clean the connectors prior to inspection to make subtle damage more apparent. If any of the above is noted, replace the assembly before its further use results in equipment damage. Also inspect the mating connectors for similar damage.

Table A-1 provides both Weinschel Engineering specifications and MIL-C-39012C data for the pin height of the various types of connectors. Pin height is defined as the vectorial distance along a horizontal axis of the pin shoulder from the electrical/mechanical reference plane.

Table A-1. Pin Height Specifications

CONNECTOR TYPE	W/E SPECIFICATION [1]			MIL-C-39012C
	MALE	FEMALE	SEXLESS	
7 mm	N/A	N/A	0.000 + .000 − .002[2]	See Figure A-1
N type	0.208 min	0.207 max	N/A	See Figure A-2
SMA	0.000 + .000 − .010	0.000 + .000 − .030	N/A	See Figure A-3
WPM	0.000 + .000 − .010	0.000 + .000 − .010	N/A	See Figure A-3
WPM-3	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
WPM-4	0.000 + .000 − .005	0.000 + .000 − .005	N/A	See Figure A-3
BNC	+ .210- + .230	+ .186- + .206	N/A	See Figure A-4
TNC	+ .210- + .230	+ .186- + .206	N/A	See Figure A-5

1 In all cases WE mates with MIL-C-39012C non-destructively.

2 Complies with IEEE Standard 287

Inspect the connector interface for signs of debris. Debris may be in the form of:

- Plating chips or other metal particles
- Dust or dirt
- Oily films
- Other miscellaneous foreign particles

If signs of debris are present, clean the connector interface as directed in Paragraph A-6.

A-3. MAKING INITIAL CONNECTIONS

Exercise caution when mating cables. Poor connections lead to poor system performance. They can also damage not only the cable assembly, but more significantly, front or rear panel connectors on the equipment itself which may be more difficult to repair.

ALIGNING CONNECTORS

Align the center lines of two connectors before actual mating. Male retaining nuts contain a small amount of necessary play which may make it possible to mate the threads without the pins being properly aligned. Pin misalignment can damage pins and dielectric inserts.

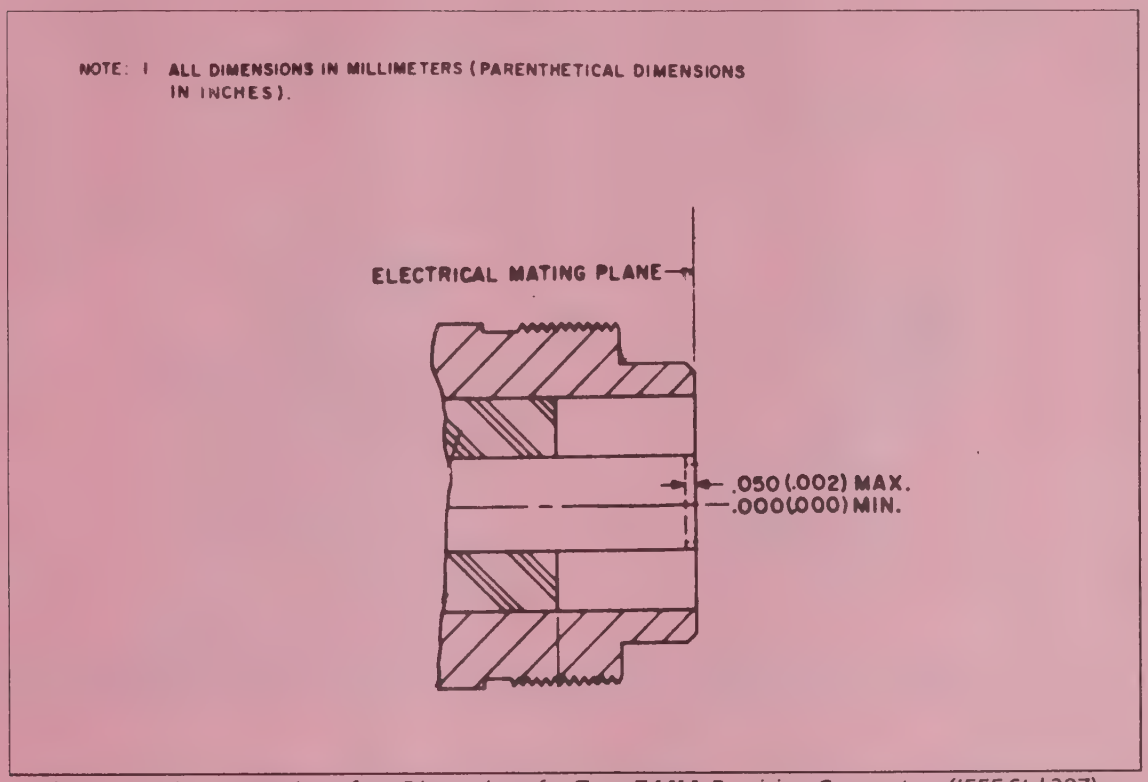

NOTE: 1 ALL DIMENSIONS IN MILLIMETERS (PARENTHETICAL DIMENSIONS IN INCHES).
ELECTRICAL MATING PLANE
.050 (.002) MAX.
.000 (.000) MIN.

Figure A-1. Important Interface Dimensions for Type 7 MM, Precision Connectors (IEEE Std 287)

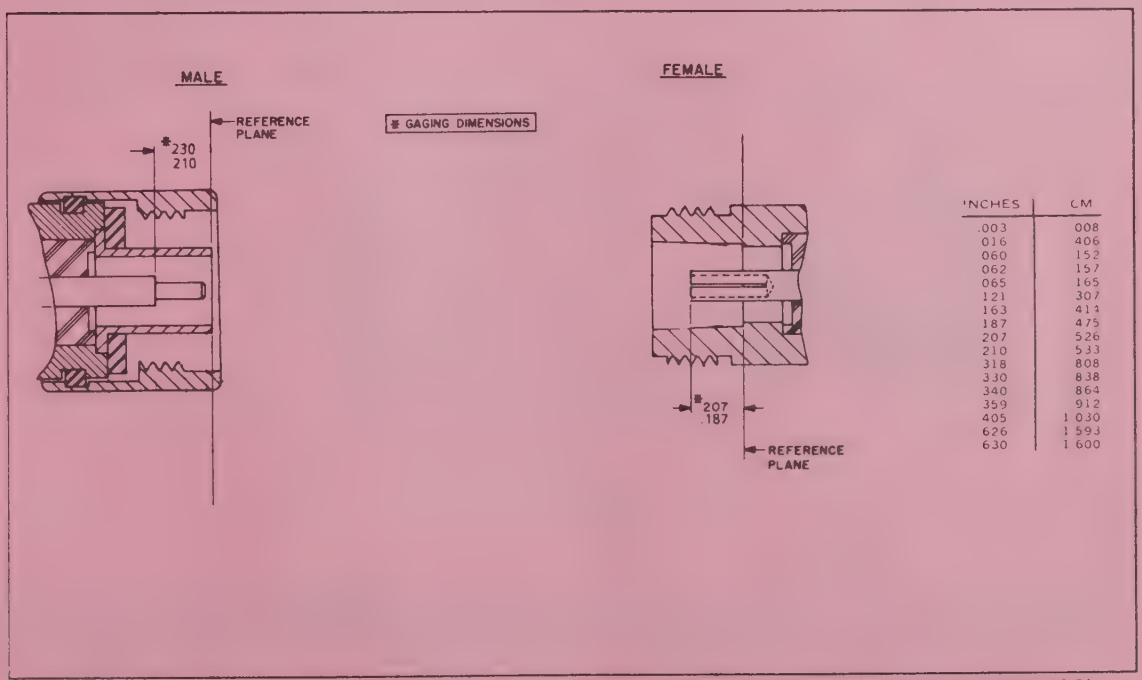


Figure A-2. Important Interface Dimensions for Type N, Class II Connectors (MIL-C-39012/1&2)

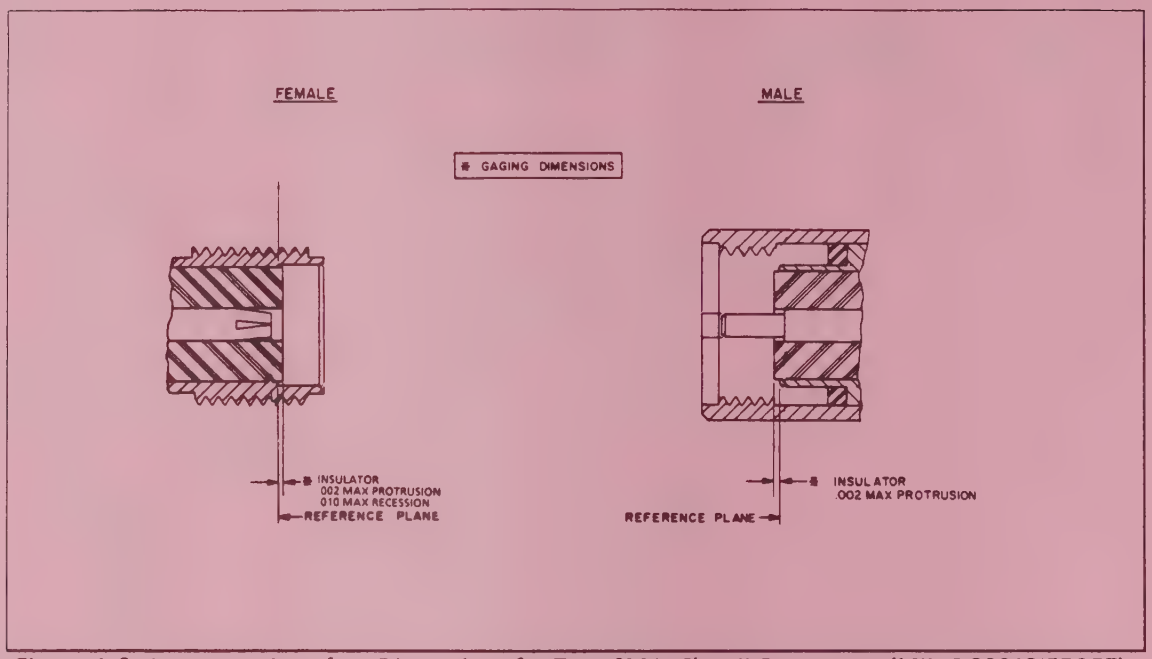


Figure A-3. Important Interface Dimensions for Type SMA, Class II Connectors (MIL-C-39012/55&57)

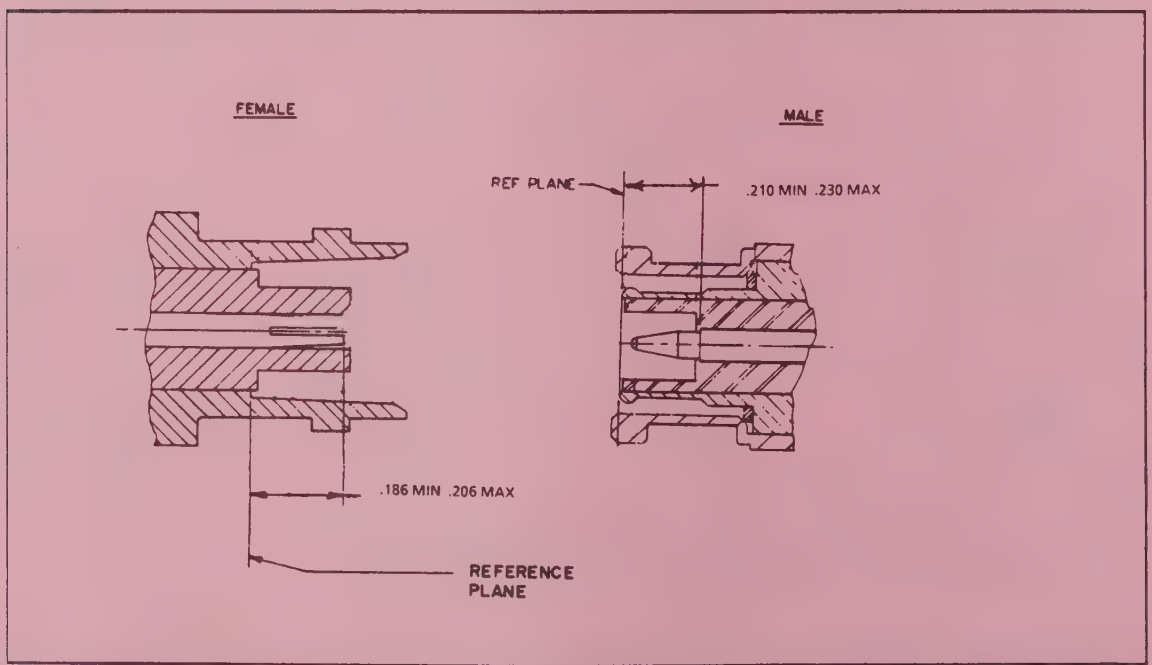


Figure A-4. Important Interface Dimensions for Type BNC, Class II Connectors (MIL-C-39012/16&17)

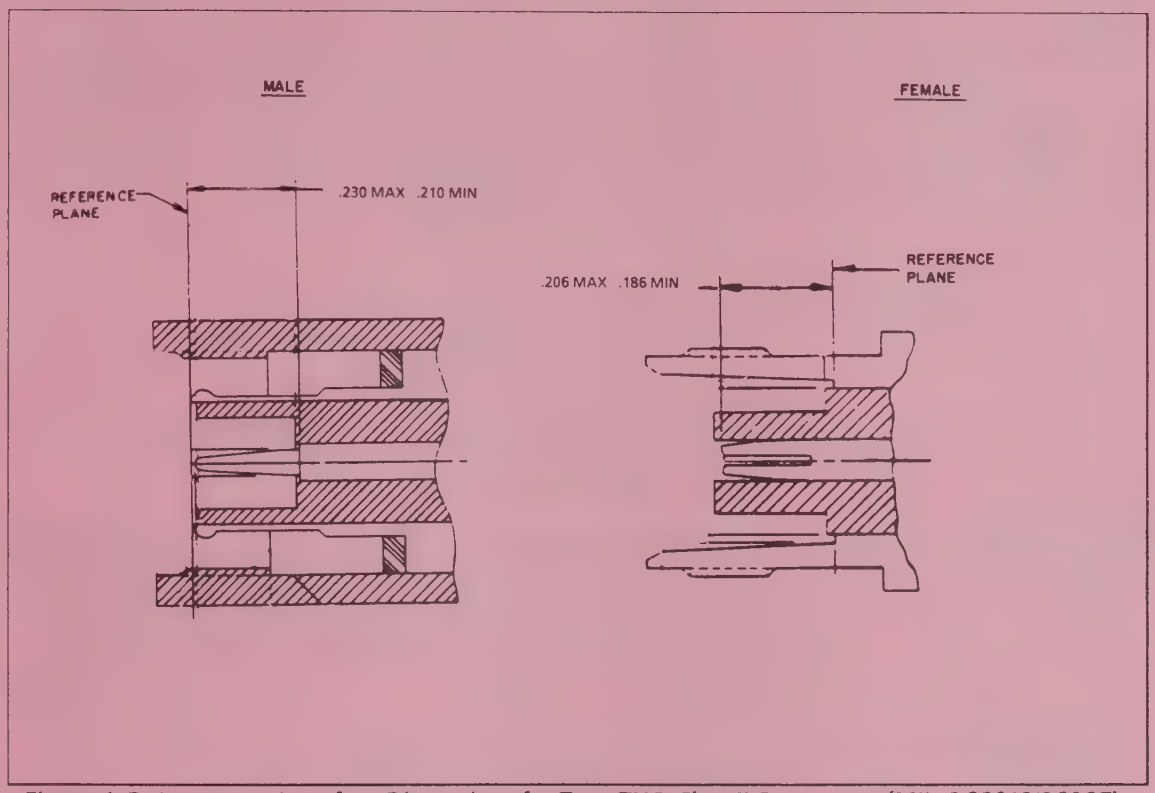


Figure A-5. Important Interface Dimensions for Type TNC, Class II Connectors (MIL-C-39012/26&27)

MATING CONNECTORS

Gently mate the connectors by hand, taking care not to force the coupling nut at the slightest resistance. It is often possible to *feel* whether or not the pins are mated. If the coupling nut is difficult to turn, either the pins are not mated, the coupling nut is cross-threaded, or one of the connectors has been damaged by excess torque.

Never hold a male connector coupling nut stationary while screwing a female connector into it. This rotation can erode the plating and damage both the outer interface rim as well as the pin. If the pins become locked, serious damage can result to both the equipment and the cable assembly.

A-4. ENSURING PROPER CONNECTOR TORQUE

OVERTORQUING

Once connectors have been properly mated, apply only the proper amount of torque. Overtorquing damages both connectors involved. Also, a connector which has been damaged by overtorquing, in turn, damages every connector to which it is subsequently mated. It usually leads to poor system performance as well. Overtorque can cause:

- Bent pins
- Recessed or protruding pins
- Recessed or protruding dielectrics
- Chipped plating
- Damaged coupling threads
- Coupling nut retaining ring damage
- Mushroomed outer interface shells
- Mushroomed pin shoulders

HEX-NUT TYPES

To mate a connector of the hex-nut type, always use a torque wrench set to the correct torque value. Tighten the connector slowly until the wrench *snaps*. Tightening too quickly can cause the wrench to exceed its set limit. Do not snap the wrench more than once as this also causes overtorque.

KNURLED NUTS

Tighten connectors with knurled nuts by hand. If this does not provide sufficient tightness use a hex-nut connector and torque wrench instead. *Never use pliers to tighten a connector.* Table A-2 recommends torque specifications for the various types of connectors.

Table A-2. Connector Torque Recommendations

CONNECTOR TYPE	RECOMMENDED TORQUE
7 mm connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
Type N connector with hex nut	14.0 in./lbs. ± 1 in./lbs.
SMA connector	7.5 in./lbs. ± .5 in./lbs.
WPM	7.5 in./lbs. ± .5 in./lbs.
WPM-3	7.5 in./lbs. ± .5 in./lbs.
WPM-4	7.5 in./lbs. ± .5 in./lbs.
Type N connector (knurled)	hand-tight
TNC connector (knurled)	hand-tight
BNC	hand-tight

A-5. PROPER CABLE HANDLING

Never exceed the minimum bend radius specified for a cable. Guard against tight bends at the end of connector strain relief tubing, or at the ends of marker tubing where they may be less noticeable. Although cable bend may seem slight, the actual radius of the bend at the point of angular departure may be far smaller than the acceptable radius.

Never pinch, crush or drop objects on cable assemblies. Also, do not drag a cable over sharp edges as this will pinch it and cause it to exceed the minimum bend radius.

Never use a cable assembly to pull a piece of equipment. Cables and connectors are not designed to support or move equipment.

SECURING CABLES

Use toothed, rubber-lined "P-clamps" to hold cables in place. If it is necessary to use tie-wraps, use the widest possible wrap and the lowest setting on the gun to ensure the minimum pressure on the cable.

STORING CABLES

When storing cables, minimize cable "set" by coiling them in large diameters (1 or 2 feet). Unroll the cable properly when it is ready to be used; do not pull the loops out hastily. Similarly, re-roll them when storing them away again.

A-6. CLEANING CONNECTOR INTERFACES

Use the following guidelines in cleaning connector interfaces:

A. Do not use chlorinated solvents including common tap water. These solvents are extremely penetrating and sometimes ruin otherwise good devices and assemblies.

B. Moisten a cotton swab with isopropyl alcohol. Roll the swab on a paper towel to remove excess.

C. Use the moistened cotton swab to wipe away debris. Do not try to dissolve the debris by overwetting the swab.

D. Repeat the cleaning process using additional swabs as necessary. If metallic particles are embedded in the dielectric, use an eyeglass and a sharp pick in an attempt to dislodge them. Swab again.

E. When satisfied that the interfaces are clean, blow them dry with dry compressed air, or preferably dry nitrogen (pressurized spray cans work well). Do not use breath.

F. Clean the mating connectors. These may be the source of the debris.

Model 8200 (IM-214) Revision Record

REVISION	DATE	DESCRIPTION	APPLICABLE SERIAL NUMBERS
A	12/89	Initial Issue	All Units
B	8/90	Added Supplement I	Al I Units

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